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INDUSTRIAL RESEARCH ASSOCIATIONS

IN 1915, England laid the foundations of a permanent organisation for the promotion of scientific and industrial research, in response to an united demand by persons engaged both in science and industry. At the outbreak of the last War, many of Britain's industries were faced with a serious crisis; they realised the extent of their dependence with regard to certain essential articles, the manufacture of which had been monopolised by foreign countries, particularly by Germany. Scientific research in Germany had been more thoroughly and more effectively harnessed to the solution of industrial problems and to the development of economic and scientific methods of production. Arthur Henderson wrote: "It is impossible to contemplate without considerable apprehension the situation which will arise at the end of the war unless our scientific resources have previously been enlarged and organised to meet it. It appears incontrovertible that if we are to advance or even maintain our industrial position we must as a nation aim at such a development of scientific and industrial research as will place us in a position to expand and strengthen our industries and to compete successfully with the most highly organised of our rivals. The difficulties of advancing on these lines during the war are obvious and are not underestimated, but we cannot hope to improvise an effective system at the moment when hostilities cease, and unless during the present period we are able to make a substantial advance we shall certainly be unable to do what is necessary in the equally difficult period of reconstruction which will follow the war."

In 1917, the British Government put forward a scheme for the encouragement of industrial research by co-operative associations of manufacturers. With a view to give practical shape to the scheme, the Government placed at the disposal of the Department of Scientific and Industrial Research, a fund of a million pounds sterling which was to be utilised in rendering financial aid to such of those groups of industrialists who voluntarily chose to organise themselves into Research Associations with the specific object of undertaking research on problems of common interest. Industrial concerns participating in the scheme were obliged to subscribe an equal amount towards the prosecution of such researches; they were, in consequence, entitled to certain privileges, such as, the right to elicit information on technical matters relevant to the industry, the right to recommend specific subjects for research, and the right to use any patents or secret processes resulting from the researches undertaken under the auspices of the Association. In addition, they would be entitled to receive a regular service of summarised technical information, thereby keeping themselves abreast of technical developments and to obtain a translated copy of any foreign article in which they may be specifically interested.

British manufacturers readily responded to these proposals and organised themselves into several Research Associations each representing a particular trade or type of manufacture. They were asked to make free use of the facilities offered by the several laboratories attached to the universities, technical colleges and research institutes. The industrialists soon began to realise in a practical manner the value of research as the most effective means of combating competition, of enhancing the quality and prestige of their products and stabilising their industry. The Government were thus able to demonstrate the importance of scientific research in relation to industrial advancement and national prosperity. The Research Association scheme which was launched some thirty-five years ago, has proved a great success. The financial contributions to research by private enterprise to-day far exceed those endowed by the Department of Scientific

and Industrial Research. Many of the Research Associations have reached such a state of self-sufficiency that they are able to carry on their work without receiving any further subsidies from the Government. Some of them have built their own lavishly equipped and efficiently staffed research laboratories. For the continued maintenance and expansion of a prosperous export trade, the work carried out by these Research Associations, have proved invaluable. Very recently, a plea for the increased awareness of the part that must be played by industrial research in post-war Britain has been made in a report compiled by a special committee of the Federation of British Industry: "Research, it is stated, has an even greater part to play in the future, than it has played in the past. Britain's position as the leading exporting nation can only be recaptured by establishing a high degree of superiority and originality in industrial products. British industry will be required not only to maintain the highest measure of productive efficiency but to introduce new materials, to develop new products and through collaboration between scientific, technical and productive personnel of industry, generally to mobilise the whole of our industrial resources in the interests of national prosperity."

Thanks to the farsighted statesmanship of Sir Ramaswami Mudaliar, the Board of Scientific and Industrial Research was constituted soon after the commencement of the present conflict, to promote the advancement of pure and applied research in this country. Under the able and inspiring leadership of Sir S. S. Bhatnagar, the Board has made substantial progress. Plans for post-war research are being drawn up and proposals for the formation of a National Research Council for directing and co-ordinating the research activities have been put forward. Several important schemes of research are now in progress in the various laboratories throughout the country. These are being financed by the Board of Scientific and Industrial Research. Leading industrialists have become increasingly conscious of the importance of research and they are making every effort to consolidate the position of their respective industries. Some of the progressive manufacturers have made liberal endowments for research. But it is doubtful if they will be in a position to meet post-war competition which is expected to be both severe and ruthless unless the Central Government helps them to organise themselves into the several Research Associations each representing a particular type of product. Addressing a meeting of the All-India Manufacturers' Organisation recently held in Bombay, Sir S. S. Bhatnagar suggested the formation of Research Associations. The Government should extend their financial support and give sufficient protection to some of the more important key industries, if they should have any chance of survival during the post-war period. The manufacturers should immediately organise themselves into representative groups and put forward proposals for stabilising their industries on a solid foundation. The formation of Research Associations will naturally constitute the first step in this direction. The several research committees functioning under the auspices of the Board might perhaps take the initiative in the inauguration of these Research Associations.

'PATULIN'—A REMEDY FOR COMMON COLD

COMMON COLD is an ailment costing the nation a heavy price in sickness, unemployment and loss of several man-hours. It often leads to pneumonia, bronchitis and other respiratory complications, and weaken the system and render the body susceptible to other infections. A 100 per cent. cure for cold has been sought unsuccessfully for many years and although numerous palliative drugs have been tried from time to time, the results were uniformly disappointing. But of late, we have all read with great interest the announcement of the success of 'Patulin' in the treatment of common cold. If this achievement passes the extensive tests, it will constitute a great contribution.

Prof. Raistrick and his colleagues have isolated a metabolic product of *Penicillium notatum* Bainier and shown its antibacterial properties for both gram positive and gram negative organisms. This active inhibitor has now been identified as anhydro-3-hydroxy-methylene-tetrahydro-γ-pyrone-2-carboxylic acid and named 'Patulin'.

The story of 'Patulin' as a remedy for cold is very interesting. An almost accidental observation by Prof. Gye of the Imperial Cancer Research Fund Laboratories suggested that 'Patulin' might be useful in the treatment of common cold. When this new drug was sent to him for study, Prof. Gye had a severe common cold. Knowing its antibacterial properties Prof. Gye tried it on himself. The outcome was encouraging and he repeated the experiment on other members of his staff. Further experiments were conducted by Surgeon-Commander Hopkins at a Naval Establishment in the South East of England. The response to treatment has been encouraging. Hopkins showed that 'Patulin' has no effect in the early period of cold, probably caused by virus infection; but secondary stage which constitutes invasion with gram positive and gram negative organism can be entirely prevented. These trials, spread over a period of months, gave good results and a strong balance of evidence in favour of treated group; 57 per cent. of treated cases recovering completely within 48 hours as compared with only 9·4 per cent. of the controls.

The exact mode of action of 'Patulin' in cold is not yet known. The action *in vitro* of 'Patulin' against a number of pathogenic aerobic organisms has been studied; the results show that it possesses bacteriostatic effect; Serum and pus do not interfere. What still lacks is evidence that 'Patulin' has antibacterial activity *in vivo* and this knowledge is necessary for an understanding of the mechanism of its action and its therapeutic scope. N. N. D.

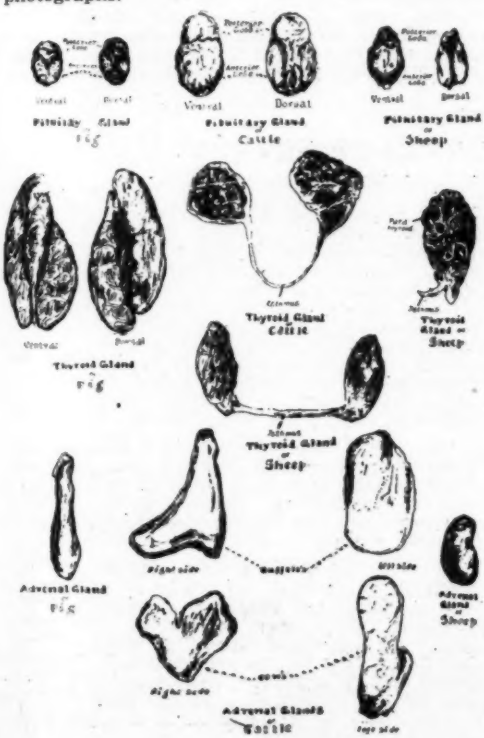
GLANDS AND GLAND PRODUCTS

I. The Endocrine Glands of South Indian Animals

BY
B. B. DEY, P. S. KRISHNAN AND M. GIRIRAJ
(Department of Chemistry, Presidency College Madras)

NO systematic data are to be found in literature regarding some of the physical and morphological characteristics such as the weights of the various glands, the proportion of medulla and cortex in the case of the adrenal glands, the ratio of anterior to posterior lobes in the case of the pituitary glands, etc., of such of the endocrine glands as are available from the slaughteries for use in the manufacture of hormones. Even where isolated data are available, they are found to be widely scattered. Some of the observations which have been made during the past three years with the glands collected from the Madras Corporation Slaughter House, are therefore considered worth recording, especially in view of the fact that these glands have shown marked differences from the figures reported in literature in respect of several of their physical characteristics.

The morphological characteristics of some of the commoner glands of the South Indian animals—the thyroid, the adrenal and the pituitary—are illustrated in the following photographs.



It will be noted that the thyroid glands in the case of both cattle and sheep, possess a long and narrow isthmus, whereas in the case of the pig, the two lobes are fused together lengthwise, so that the description given in literature that the shape of the thyroid glands resembles that of a purse with the flaps opened up, seems to apply only to the pig thyroids. It will also be noted that whereas the adrenal glands of sheep are of a uniform elongated, oval structure, those of the cattle are uneven in contour, showing deep clefts in several cases. Again, the left adrenal differs in appearance from that of the right, and the adrenals of the cow often show a marked difference in shape from those of the buffaloe.

In the following table are given figures for the weights of the adrenal, the thyroid and the pituitary glands in the case of cattle. sheep and pig.

TABLE I

	Thyroid (2 lobes together)	Adrenals (a pair belonging to one animal)	Pituitary
Cattle	8 to 12 g.	8 to 11 g.	0·8 to 1·2 g.
Sheep	1·5 to 2·5 g.	1·5 to 2·5 g.	0·25 to 0·40 g.
Pig	3 to 5 g.	2 to 4 g.	0·1 to 0·25 g.

If these figures for cattle are compared with the corresponding values given in literature for animals in Europe, *viz.*, 30 g. as the weight of ox thyroids, 25 g. as the weight of ox adrenals and 2·5 g. as the weight of the ox pituitary, it will be seen that these endocrine glands of the Indian animals, or at least of those of South India, are very much smaller than those of the European and American domesticated animals.

In the following table are given values for the percentage of medullary tissue in the case of the suprarenal glands of cattle, sheep and pigs, the rest being made up of the cortex.

TABLE II

	% Medullary tissue
Cattle .	25 to 29
Sheep ..	17 to 20
Pig ..	17 to 20

Cattle adrenals thus possess the maximum amount of medullary tissue.

In Table III is given the ratio of anterior to posterior lobe in the case of the various pituitary glands. (Only a few pig glands were available so that the values reported may not be quite representative).

TABLE III

	Anterior lobe/Posterior lobe (ratio)
Cattle ..	2·3 to 2·8
Sheep ..	8 to 11
Pig ..	1·2 to 2·0

In the case of the ox pituitary of European animals where the whole gland weighs 2·5 g., it has been reported that the posterior lobe weighs only 0·5 g., so that the ratio of anterior to posterior lobe should be 4. In the case of the Indian cattle, therefore, although the total weight is nearly half, the proportion of the posterior lobe is considerably higher, so that they appear to be ideal for the preparation of the posterior pituitary products. Sheep pituitary will be seen to be a very poor source of the posterior lobe; it is, on the other hand, best suited for the preparation of the anterior pituitary hormones.

It is interesting to note that the glands of the three classes of animals, cattle, sheep and pigs, used for slaughtering, not only show marked variations in size and shape, but also in their contents of some of the essential chemical constituents. Data for three of these constituents, *viz.*, vitamin C in the case of the whole adrenal and pituitary glands, adrenaline in the case of the adrenal glands and iodine contents of thyroids, some of which have already been reported in publications appearing from this laboratory from time to time, are collectively presented below (Table IV).

TABLE IV

	Vitamin C content of the adrenals (mg./g. of fresh tissue)	Vitamin C content of pituitary (mg./g. of fresh tissue)	Adrenaline content of adrenal glands (mg./g. of fresh tissue)	Iodine content of thyroid (% of desiccated glands)
Cattle	1·24	1·43	2·24	0·91
Sheep	1·36	1·75	1·60	0·66
Pig	..	..	0·8	0·84

It will be noted that sheep glands are richer in vitamin C than the corresponding glands of cattle and again the pituitary is richer in this vitamin than the adrenal.

Our thanks are due to the authorities of the Madras Corporation for facilities for the collection of the various glands from the Slaughter House and to the Superintendent of the Slaughter House for help in the cellection and identification of the glands. We are also deeply indebted to Rao Sahib Chelva Aiyangar of the Madras Veterinary College, for his invaluable instructions in the methods of identification and dissection of the glands. The expenses of this investigation were met by a grant from the Board of Scientific and Industrial Research, to whom our thanks are due.

THE ORIGIN OF CURVES IN RIVERS

By MOHAMED SALEH QURAISHY, B.E., Ph.D., D.I.C.

Introduction

IT is well known that in most cases, natural water-courses, flowing freely through incoherent material, adopt a sinuous or meandering course, with curves alternating with right and left. There are various hypotheses purporting to explain the origin of this somewhat universal characteristic of natural streams. By way of illustration, we have one of these explaining this phenomenon as due to the earth's rotation, referred to as Baer's Law (Baer, 1857-58) or Coriolis' Effect (Coriolis, 1835); according to the other, the curves are initiated by alternate eddies of the type generated behind a bluff body (Stanley, 1881; Exner, 1919); according to James Thomson (1877), the development of curves is due to secondary flow; according to Möller (1883), an initial asymmetry of the cross-section is responsible for the origin of curves; according to many (amongst whom are also hydraulicians), the curves are due to the river having been initially deflected from its straight course by either an obstacle (Dubuat, 1786; North, 1928) or an initial incurvation (Exner, *op. cit.*; Tiffany and Nelson, 1939); whereas according to some, this tendency is due to the river becoming old and infirm, when in carrying its sedimentary burden, it rambles about.

The question occupies an exceptionally important position in River Engineering and I have investigated it experimentally. I find that Thomson's explanation, which strictly speaking concerns *the development of any existing curves*, is true, as far as it goes. As for the initiation of curves, observations show that the earth's rotation could not be the concerned cause (Quraishy, 1943), whereas the presence of an obstacle, initial incurvation, initial asymmetry of the cross-section, etc., is not necessary to the occurrence of the curves.

The curves originate even in a channel with the sides quite straight and the bed very even. They actually arise as a result of certain interactions between the flowing water and the sediment particles, by a series of easily ascertainable actions.

A study of these actions supplies quite a rational explanation of such formations as convex shoals and secondary channels and also explains many other interesting phenomena, ordinarily speculated upon. A short account, describing how the curves come into being, is given here, whereas a fuller discussion (including also an investigation on the nature of the interactions) is incorporated in a paper to be published elsewhere.

Apparatus

The experiments were performed in an open welded steel flume, 30 ft. long and of rectangular cross-section, 2 ft. 6 in. wide by 1 ft. 6 in. deep. Two jack-screws, one at each side, supported it at its upper end. By these, the channel could be given a variety of initial slopes.

In the channel bottom, wet sand of mean grain diameter 0·70 mm. was placed to a depth of 6 in., and the working channels (straight and with even bed), in this sand, were swept out by wooden templets of the necessary dimensions. Water was supplied at a uniform rate from an overhead tank and so was dry sand, representing 'bed-load', by a device, which was suggested to the author by Dr. C. M. White.

Its construction rested upon the principle that any incoherent material, when free to flow, always tends to assume its angle of repose. And so, no sooner one lot is removed away, than another automatically takes its place. The sediment was stored in a box with an adjustable slit, through which it flowed out freely and was removed away by a flue brush driven at a regular speed by a small motor.

Besides these, use was made of a measuring tank, a thermometer, a point gauge, a spirit level and a balance, to record various details.

Bed Deformation: Formation of the Skew Scales

Generally, with the commencement of an experiment, the topmost grains began to roll and skip all over the bed, moving in jerkey but on the whole, straight paths parallel to the channel sides. But within a short time, sometimes almost as soon as the experiment commenced, there was vigorous local scour of the bed close to the channel sides, alternating with left and right, in all probability due to vortices suspected to be skewed out of the vertical.

These seemed to originate in consequence of the breaking up of the stream at these positions, due to its being deficient in energy and momentum. Experiments, where the formation of ripples was suppressed, without arresting the sediment motion, by sucking away the retarded stratum close to the bed, lent strong support to this view.

The material appeared to be scooped out and pumped towards the centre where it came to rest in a systematic manner. When carefully examined, the fish-scale pattern was found to be twisted towards the one or the other side of the channel, something like Fig. 1 A. We call these *the skew scales*.

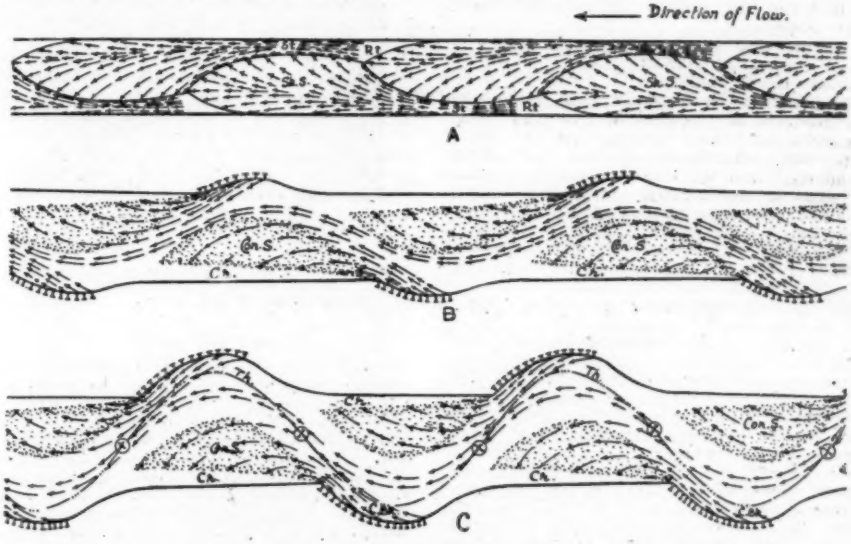


FIG. 1. Illustrating the Sequence of Features Leading up to a Meandering Stream

A shows well-developed skew scales, *i.e.*, skew shoals. The tracks of particles coming from the stems (*St.*) are curvilinear. As the skew shoals attain an optimum size, bights develop and the finer details of the shoals get masked. This is illustrated by *B*. Then the curves develop. As shown in *C*, the material removed from the concave banks follows the arrows and is mostly deposited downstream as indicated. Between the shoals and the channel bank, there are secondary channels or creeks (*Cr.*), where would gather foam and dirt.

C. Bk.—Concave Bank; *Con. S.*—Convex Shoal; *K.*—Kink; *Rt.*—Root; *Sk. S.*—Skew Shoal; *St.*—Stem; *Th.*—Thalweg; ⊗ Crossing; ππ Caving Bank; ← Particle Track.

These skew scales were just a few grains thick but their pitch was anything from 50 to 500 times their thickness. Slowly they grew up, as they were continuously nourished by the scoured material from places which in Fig. 1 A are denoted by *St.* We name these *the stems*. For purposes of standardisation, we call the upper ends of these *the roots*. The position of these roots lay nearly opposite to

a kink, marked in the figure as *K*. The paths of sediment grains coming from these stems were curvilinear: the strokes in Fig. 1 A have been drawn to exemplify these paths.

This sequence was, however, found in experiments in which the variables were fairly well represented. In other experiments, there were some intermediate formations, hardly like the skew scales, but all invariably leading to the skew shoals (advanced stage of the skew scales).

There were also cases, where the skew scales appeared successively. For example, they would originate upstream and migrate downstream, till the whole channel bed had been covered with them, or again initiate at the downstream end first and appear elsewhere subsequently. All such processes were, however, very slow and this peculiarity had some bearing upon the subsequent behaviour of the stream—upon the manner in which the particles moved and upon the varicus associated phenomena. It seemed to us as though the more rapid movements produced close consilience, whereas the slower ones gave rise to dissimilarities.

The Skew Shoals and the Initiation of Curves

All such skew scales, with more or less a constant pitch in the flow direction, bulged out in other directions. In their mature form, they looked something like long-drawn out dunes, in which state we name them *the skew shoals*. As soon as the height and breadth of these shoals became sufficiently great, the channel sides began to be scoured alternately, just opposite the widest part of the shoals. Simultaneously, it appeared as though the forward migration of the shoals had ceased: the well-defined skew shoals had been deprived of their beautiful pattern and now presented only a smooth, washed out appearance (Fig. 1 B).

This marked the initiation of curves. Both the skewness and the curvature of the shoal boundaries seemed essential for this to happen. But the mechanism involved appeared somewhat complicated and could not be fully grasped. What was, however, clear was that a type of secondary flow was set up: the faster fluid moved outwards and scooped out material from the bank. Once this action started, the effect was progressively intensified due to the outer boundary becoming more and more curved, so that, ultimately we had a channel like the one illustrated in Fig. 1 C, where the arrows, once again, depict the tracks of the sediment particles.

Other Interesting Facts

Fig. 2 A, reproduced from a previous note by the author (1943), shows such a channel with the water flowing through it, whereas Fig. 2 B shows the same channel with the water drained off. In this laboratory river, one can clearly observe all the prominent features generally associated with large rivers (*cf.* Fig. 1 C). These include concave banks, convex shoals, secondary channels or creeks, deeps, shallows, crossings, etc.

The secondary channels or creeks, often erroneously adduced by river engineers to the inequalities in the settlement of suspended silt, when the flood waters subside, are the result of the peculiar manner in which the particles are transported and deposited and come into

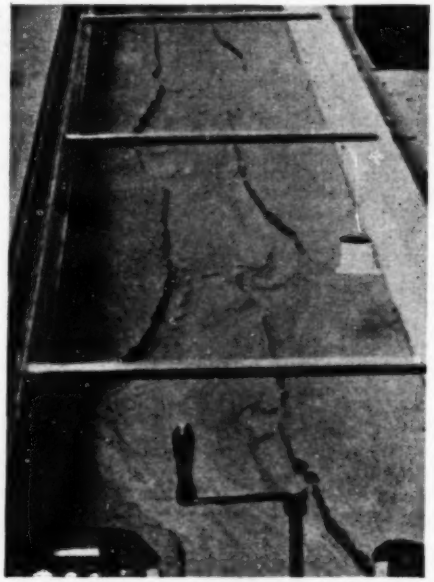


FIG. 2. Photographs of a Meandering Stream

A—With water; *B*—Without water

being as soon as the scales are formed (*vide* Fig. 1 A). These were filled with retarded water and remained opened at their downstream ends. An effect of surface tension could be seen in the accumulation of foam and dirt on the surface of this retarded water: in the photograph in Fig. 2 A, bright bands against the banks (just below the concave banks) are due to this.

The edges of these creeks appeared to move outwards, towards the banks. But whereas we are apt to think of the creeks ultimately fading away, we saw that in actual fact this was not so: there was a certain increase in the amplitude and the shoals continually travelled downstream, so that the triangular creeks maintained their identity.

The concave banks (Fig. 1 C) appeared to cave in: the material was either wholly washed into water or slipped down. The banks became more or less vertical, with their toes curved, and the particles caught and moved forward, were distributed as shown. As a result of this kind of radial and tangential erosion, the curves expanded radially and simultaneously migrated downstream. Fig. 3 is an example of the sequence of the water surface profiles, in plan, assumed progressively with time. The insets show cross-sections at typical places, with the water surface elevated towards the concave sides, due to the centri-

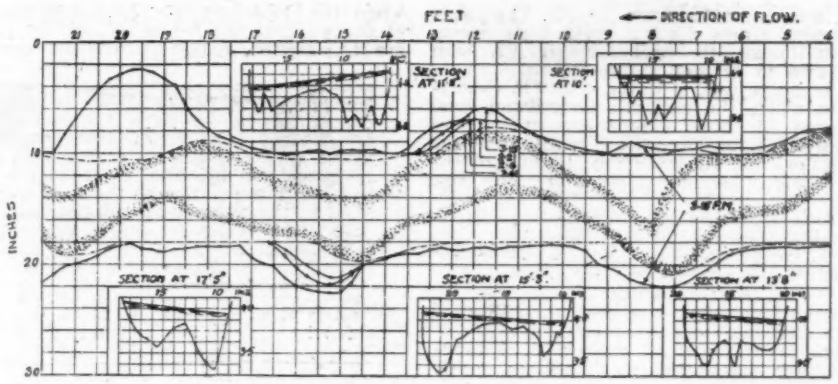


FIG. 3. Periodical Profiles in Plan of a Typical Meandering Stream

(Discharge 0·021 cusec., sediment feed 1·0 gm./sec., initial channel slope 1 : 300, and initial width at the bed 6 in.)

Region within dotted border presents channel bed where the sediment motion was extremely lively at that stage. Bold lines mark the position of water surfaces at the times indicated by the attached figures. These illustrate also the lateral and tangential expansion of the curves.

fugal force (in virtue of the curvature of the curves).

CRITICAL TESTS

Critical tests were made to determine with certainty that the skew shoals preceded the initiation of curves. In these first one and then both sides were reinforced. The photograph in Fig. 4 shows the skew shoals with fine sand, approximately 0·21 mm. in diameter. The channel had both sides rigid and was barely 2 in. wide. It was given a very steep slope, but the discharge was just a few c.c. per second.

All these tests led to the conclusion that the skew shoals were precisely responsible for the origin of curves in rivers, which initially can be quite straight and have an even bed.

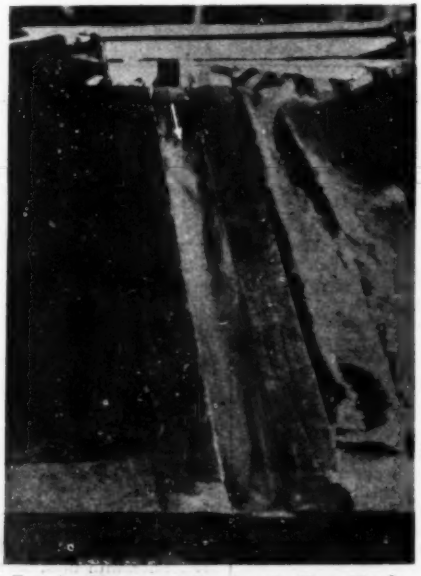


FIG. 4. Photograph Showing the Skew Shoals

ACKNOWLEDGMENTS

The study was made possible by the grant of a scholarship by the University of Bombay for higher studies abroad and by the facilities freely placed at my disposal in the Hydraulic Laboratory of the Imperial College of Science and Technology (City and Guilds College), London, by Dr. C. M. White. I am greatly indebted to them.

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THE CYTOGENETICS OF AN AMPHIDIPLOID *SESAMUM ORIENTALE* × *S. PROSTRATUM*

By S. RAMANUJAM

(*Imperial Agricultural Research Institute, New Delhi*)

IN a previous communication the author[1] reported that a hybrid between *S. orientale* = *S. indicum*, n = 13 and *S. prostratum*, n = 16) was obtained for the first time and subjected to colchicine treatment for production of amphidiploids. The present note is a preliminary description of the cytogenetical behaviour of the amphidiploids.

A_1 Generation

Eight hybrid plants were treated with 0·4 per cent. aqueous solution of colchicine when they were in the seedling stage with 6 to 8 leaves. After treatment, the seedlings grew very slowly with all the symptoms of induced polyploidy; the mature plants had thicker and broader leaves, bigger and more hairy flower buds and flowers than the untreated plants. One flower in each branch of the different treated plants was examined for pollen size and fertility and it was found that the percentage of fertile grains varied in amount in the different flowers but they were bigger than those of either parent. Fig. 6 in the previous note shows photographs of pollen grains in the parents, in the F_1 hybrid and in a fairly fertile flower on a treated plant. The capsules formed on the different branches of the eight treated plants were examined for seed-setting. Although a good number of seeds set in most of the capsules, a closer examination revealed that a large proportion of them were only 'developed ovules' with no embryos in them. The branches in all the eight plants were grouped into three classes on the basis of pollen fertility and the number of capsules, true seeds and developed ovules formed in each class is given in Table I.

TABLE I

Percentage pollen fertility	5–20 (Class I)	21–40 (Class II)	41–60 (Class III)
No. of branches	147	15	4
No. of capsules	89	19	3
No. of true seeds	7	33	33
No. of developed ovules	1128	405	39
Percentage of true seeds per capsule	0·63	7·3	45·8

It is interesting to notice that a large number of 'developed ovules' are formed on these plants and that the proportion of true seeds to developed ovules increases with the increase in pollen fertility.

A_2 Generation

Morphology of A_2 Plants.—A large number of 'developed ovules' and good seeds were sown

TABLE II

Details of characters	*S. orientale*	*S. prostratum*	Amphidiploid *S. orientale* × *S. prostratum*
Habit	Erect	Prostrate	Semi-erect and more vigorous than the parents.
Leaves	Petiolate, oblong to ovate, lower lobed palmately and upper simple with almost entire margin	Short petioled, simple, orbicular with crenate margin	Petiolate, simple throughout with a slight tendency to lobation in a few of the basal leaves, orbicular with dentate margin.
Inflorescence	Raceme; flowers solitary, axillary with two discoid gland-like structures representing rudimentary flowers	Raceme; flowers solitary axillary with no rudimentary gland-like structures	Raceme; flowers solitary, axillary with imperfectly developed glandular structures.
Flowers	Pedicellate, bracteate, zygomorphic, hermaphrodite, with very light purple corolla	Pedicellate, bracteate, zygomorphic, hermaphrodite, with purple corolla	Bigger in size, pedicellate, bracteate, zygomorphic, hermaphrodite (female-fertile, variably male sterile), with light purple corolla.
First flowering (days from sowing)	40	90	60
Fruit	Capsule four-chambered, quadrangular, 2·6 cm. long, 0·6 cm. broad opening from above; loculicidally down to about the base	Capsule ovoid, compressed, with tough pericarp, 1·9 cm. long, 1·0 cm. (at base) and 0·7 cm. (at apex) broad, opening loculicidally from top to only a short distance below	Capsules four-chambered, quadrangular, with tough pericarp, 2·1 cm. long, 1·0 cm. broad, opening loculicidally from top to less than half the capsule-length below.
Seeds	Many, white, smooth, with thin testa	Fewer, black, deeply reticulate, with thick testa	Many, black, larger than in both the parents, deeply reticulate, with thick testa.
Average weight of 100 seeds	0·3301 gm.	0·2340 gm.	0·4408 gm.

during 1943-44. While all the developed ovules failed to germinate, a majority of the good ones germinated and gave rise to 35 mature plants. All plants, except four, were very vigorous and more or less uniform for habit (semi-erect), flowering and other morphological characters. A reference to the four exceptional plants will be made later in the note.

Table II gives a brief summary of the morphological features of the parental species and the group of 31 plants obtained from colchicine-treated hybrids.

Cytology of A, Plants.—Thirty-one out of 35 plants had 58 chromosomes as their somatic number which is equivalent to the sum of the somatic numbers of the two parental species. Hence it is clear that all these plants are amphidiploids resulting from the duplication of chromosomes in the F, hybrid. The meiosis in the amphidiploids was very regular with the formation of 29 bivalents at metaphase I, which underwent even separation at anaphase I; metaphase II in many cells showed two groups of 29 chromosomes in each, although very occasionally 30 + 28 grouping was noticed. Figs. 1 and 2 represent metaphase I and II, respectively, in an amphidiploid plant. In spite of the regular meiosis, a high percentage of pollen sterility (60-90 per cent.) was noticed in the amphidiploid plants. But the capsules developed in a large majority of the flowers and contained many apparently good seeds. A closer examination again revealed that many of the seeds were only 'developed ovules'. The seed-setting in 22 amphidiploid plants is given in Table III.

TABLE III

Percentage of true seeds per capsule (average of 10 capsules)	10	10–19	20–29	30–39	40–49	50–59	
Number of plants	1	4	8	5	3	1	Total 22

The four exceptional plants resembled the *prostratum* parent in habit although more vigorous than the latter. They had forty-five somatic chromosomes and showed a typical 'Drosera scheme' of pairing at meiosis; 16 bivalents and 13 univalents were invariably noticed at metaphase I. Fig. 3 represents metaphase I in one of these plants. Evidently these plants had resulted from natural crossing between 'doubled' hybrids and *S. prostratum*.

Discussion

The entirely different morphology and chromosome of the amphidiploid together with its regular meiosis and true-breeding nature justify its being classified as a new species. The one peculiar feature in this amphidiploid is its high pollen sterility in spite of regular meiosis, although it appears to be highly female fertile. In this respect, the present amphidiploid resembles the cotton amphidiploids produced

by Beasley[2] and Harland.[3] Beasley reported that allotetraploids produced by doubling the chromosome number in F, hybrid *G. arboreum* var. *neglectum* × *G. Thurberi* were ordinarily male sterile but rarely flowers had viable pollen. Harland, however, reported that his amphidiploid involving the same two parental species was completely male sterile. Greenleaf[4] found that amphidiploids *N. sylvestris—tomentosa* and *N. sylvestris—tomentosiformis*, in spite of being regular in meiosis in mega- and micro-sporogeneses and having over 90 per cent. good pollen were completely female-sterile. He concluded that the sterility in his amphidiploids was genic and that the sterility in the corresponding F, hybrids was genic as well as chromosomal. It is possible that in the present *S. orientale-prostratum* amphidiploid also the sterility is genic but that the genic effect is only on pollen formation and not on ovule development.

Further work on these amphidiploids in respect of their crossability with the parental species and the development of ovules and pollen degeneration are under way. Attempts to produce the amphidiploid from triploid hybrids (di-*prostratum*-mono-*orientale* plants) by back-crossing them with *S. orientale* are also in progress. A further report of the results will be published elsewhere.

It is, however, proposed to classify this true-breeding synthetic plant as a new species under the name *S. indicatum*.

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GROUND TRIPLET IN BROMINE II

Some of the main features in the first spark spectrum of Bromine were reported by Bloch and Lacroute[1] previously; but the most important deepest terms of the spectrum have not yet been identified correctly. Following the work[2] in our laboratory on the successive spectra of Bromine, it has been possible to establish the fundamental inverted triplet term $4p\ ^3P$ of Br. II, involving the classification of about thirty lines in the vacuum grating region. The intervals are found to be $4p\ ^3P_0 - 4p\ ^3P_1 = 3147$ and $4p\ ^3P_1 - 4p\ ^3P_0 = 695$ units. Bloch's identification of $5s\ ^1D_2$ had to be changed from 65657·1 to 61179·5. Full details of the analysis will be published elsewhere.

Andhra University,
Guntur, K. R. Rao.
January 11, 1944.

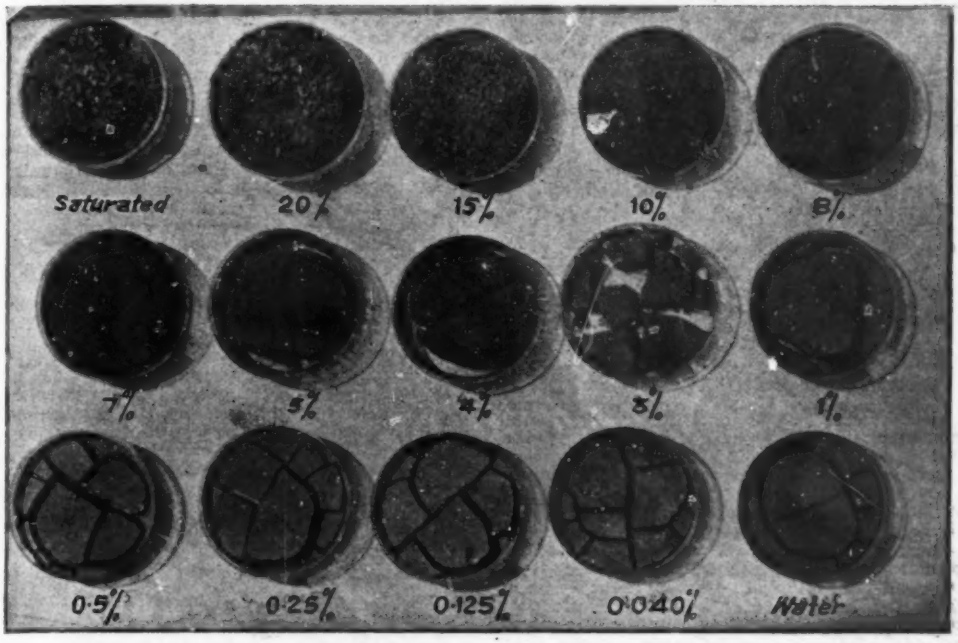
1. *Compt. Rend.*, 1934, **199**, 41 and *Ann. de Physique*, 1935, **3**, 5. 2. Rao and Krishnamurty, *Proc. Roy. Soc.*, A, 1937, **161**, 38 and *Proc. Phy. Soc.* (Lond.), 1934, **46**, 531.

ON THE EFFECT OF CONCENTRATION OF SODIUM CARBONATE IN AQUEOUS SOLUTIONS ON (A) THE FORMATION OF CRACKS, (B) SWELLING AND DISPERSION AND (C) CAPILLARY ASCENT IN THE BLACK COTTON SOIL

In a series of papers published recently[1,2,3] the present writers discussed the capillary rise of sodium carbonate solution in black cotton soil packed in glass tubes and the swelling of the soil particles when immersed in solutions of lithium and sodium carbonates and of some other salts. While a trace of sodium carbonate in water (0·03 per cent.) actually increases capillary rise, as the concentration is increased from 0·03 to about 1 per cent. there is a rapid deterioration in the permeability of the soil due to swelling of particles. Similar results obtained with solutions of other salts will be discussed in a separate paper.

In the present note we report some interesting results obtained with sodium carbonate. In this case, experiments could be made on (*a*) the development of cracks in soils mixed with sodium carbonate solutions, (*b*) swelling or dispersion of the soil in the solutions, and (*c*) capillary ascent, over a wide range of concentration (owing to the high solubility of the salt).

When samples of black cotton soil weighing 100 gr. are mixed with 60 c.c. of sodium carbonate solutions of different concentration and the pastes so formed are allowed to dry in a steam oven, the soil layers develop the well-known cracks only in the range of concentration from 0 to 5 per cent. The width of the cracks formed increases to a maximum at a concentration of 3 per cent. No deep cracks appear above 5 per cent. Between 4 per cent. and 8 per cent. the soil mass contracts *en masse* on drying and a black layer appears at the surface. This contraction also decreases with increase of concentration in the above range. Finally, at concentrations higher than 8 per cent. the precipitation of the salt prevents visible contraction, and the soil particles have no tendency to form lumps but remain powdery and porous like sand. The maximum cracking should occur at a concentration where the swelling on wetting and contraction on drying are both large. The cracked layers are hard as brick. Between 4 per cent. and 8 per cent. the dried mass is very friable. Fig. 1 shows



the appearance of the soil layers mixed with different concentrations of sodium carbonate solution when dried.

In the next experiment 15 gr. samples of black cotton soil were shaken for a minute with 100 c.c. of different concentrations of sodium carbonate solution, and allowed to settle in measuring jars. After settling was complete (i.e., after two days), the volumes of the sediments in the different concentrations were recorded. The values are given in Table I.

TABLE I

Concentration % of Na_2CO_3—0 (Water), 0·2, 0·4, 0·7, 1·0, 1·5, 2·0, 3 0, 4·0, 10·0, 20·0.

Volume of soil sediment c.c.:—24, 29, 36, 41, 43, 41, 36, 32, 26, 22, 19.

The volume of the soil sediment increases with concentration up to 1 per cent. As the concentration is increased further the volume of the sediment decreases rapidly. The supernatant liquid in solutions of concentration greater than 1 per cent. is coloured deep brown; the cause of this colour is being investigated.

The capillary rise of different concentrations of sodium carbonate solution through columns of black cotton soil during a period of 24 hours is indicated in Table II.

From Table II it will be seen that the capillary ascent *decreases rapidly from 0·03 per cent. to 2 per cent.; but it is very ramarkable that as the concentration of the sodium carbonate solution is increased further there is rapid restoration of the permeability of the soil.* Thus, a concentrated solution of sodium carbonate is found to rise through the soil at even a faster rate than pure water initially (as through sand) although pure water scores ultimately over the solution. The soil wetted by the highly concentrated solutions turns black after some time. This effect begins at the lower layers of the wetted soil and slowly moves upward along the wet column. It is to be noted in particular that although the soil becomes nearly impermeable to a 2 per cent. solution, *the permeability increases rapidly with concentration above 2 per cent.*

TABLE II

Contentration of sodium carbonate solution	Capillary rise during 24 hrs. in cm.	Concentration of sodium carbonate solution	Capillary rise during 24 hrs. in cm.
% (Water)		0·25	5·4
0	28·8	0·50	3·9
0·010	29·9	1·00	3·1
0·020	31·7	2·00	1·9
0·030	32·3	3·00	3·0
0·040	31·7	6·25	6·8
0·050	28·0	12·50	19·5
0·125	12·0	25·00	26·1

The importance of the above results in dealing with problems connected with lands affected by sodium carbonate is obvious. For a given quantity of black cotton soil there is an optimum concentration at which its auto-dis-

persion in sodium carbonate solution (*e.g.*, for mechanical analysis) will be most effective. Similarity in the influence of concentration on different phenomena like crack formation, swelling and capillary ascent is also noteworthy. A more detailed discussion of our results will appear elsewhere.

Our thanks are due to Mr. A. U. Momin for help in performing some of the experiments described above.

Meteorological Office, Poona, *January* 24, 1944.

L. A. Ramdas.
A. K. Mallik.

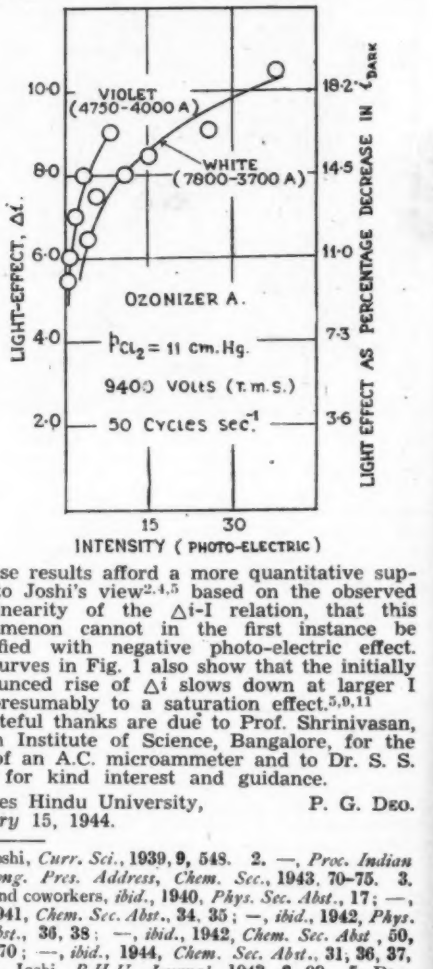
1. Ramdas, L. A., and Mallik, A. K., *Proc. Ind. Acad. Sci., A*, 1942, **16**, 1-9. 2. —, —, *Ibid.*, 1942, **16**, 16-22. 3. —, —, and Pandit, U. P., *Curr. Sci.*, 1942, **11**, No. 7, 288.

NEW LIGHT EFFECT—INTENSITY VARIATION BY DIRECT PHOTO-ELECTRIC MEASUREMENTS

Earlier results[2,4,5] for the dependence of the new light-effect defined as Δi the instantaneous diminution on irradiation of i the conductivity in chlorine[2,4,6,9] and other gases[2,3,4,7] subjected to electrical discharge, upon I the corresponding light-intensity, have shown that Δi is not a linear function of I. This has been used by Joshi to discriminate this phenomenon from the well-known photo-electric effect,[2,4,5] in which the linearity of the above relationship has been found to hold over a millionfold variation of I.[8] Due to limitations of means then at our disposal, *the inverse square law* was assumed for the large size, light-source employed, *viz.*, an incandescent filament bulb. Results now to be reported are independent of the approximations involved in the above assumption, since I varied by varying the distance of the light-source was observed directly by a G.E.C. Osram photo-electric cell.

The chlorine-filled ozoniser A, the light-source—a 200 watt 180 volt bulb, the light filters and the general experimental procedure were the same as before.[5,9,11] The intensity of the filtered green (5775-5070 A) and the sensitivity of the available cell to the filtered red (7070-6070 A) were too low for a study of Δi as a function of I for these light-bands. With about 9400 volts (r.m.s.) and 50 cycles frequency, i the current *in the dark*, was 55 on a Cambridge A.C. microammeter. The light-effect, expressed as Δi and also as a percentage of the original i in the dark, is shown graphically in Fig. 1, at various I_{white} and I_{violet}.

It is seen from Fig. 1 that the Δi-I curve for the violet lies above that for the white; for a given I, Δi under violet exceeds that due to white. Evidently, therefore, the nature of irradiation is an additional factor involved in the production of this effect, and that, at same I for both, this factor in white is less effective than in violet. This mode of observation may be referred to by (i) for shortness. Now (ii) when, *at a given distance*, the chlorine tube is irradiated directly by the bulb and then with the violet filter interposed, Δi due to the white exceeds that under (filtered) violet. The discrepancy between (i) and (ii) is only apparent. In (ii), I_{violet} is less than I_{white} being only a fraction of same. The light-effect, which is found to be produced by all the components of the white light,[2,3,4,9,10,11] should be, therefore, and is, found to be greater under white than under violet.[5,9,10,11] Since $I_{violet} = I_{white}$ in (i), irradiation by violet is comparatively stronger in the short-wave components; it is besides more, within the absorption spectrum of chlorine, than the former.[12,13] On either or perhaps both these grounds, Δi under violet should be greater than under an equally intense white light, which is actually the case (Fig. 1).



These results afford a more quantitative support to Joshi's view[2,4,5] based on the observed non-linearity of the Δi-I relation, that this phenomenon cannot in the first instance be identified with negative photo-electric effect. The curves in Fig. 1 also show that the initially pronounced rise of Δi slows down at larger I due presumably to a saturation effect.[5,9,11]

Grateful thanks are due to Prof. Shrinivasan, Indian Institute of Science, Bangalore, for the loan of an A.C. microammeter and to Dr. S. S. Joshi for kind interest and guidance.

Benares Hindu University, *January* 15, 1944.

P. G. Deo.

1. Joshi, *Curr. Sci.*, 1939, **9**, 548. 2. —, *Proc. Indian Sci. Cong. Pres. Address, Chem. Sec.*, 1943, 70-75. 3. Joshi and coworkers, *ibid.*, 1940, *Phys. Sec. Abst.*, 17; —, *ibid.*, 1941, *Chem. Sec. Abst.*, 34, 35; —, *ibid.*, 1942, *Phys. Sec. Abst.*, 36, 38; —, *ibid.*, 1942, *Chem. Sec. Abst*, 50, 51, 55-70; —, *ibid.*, 1944, *Chem. Sec. Abst.*, 31, 36, 37, 38. 4. Joshi, *B.H.U. Journal*, 1943, **8**, 99. 5. Deo, *Ind. Journ. Phys.* (Communicated). 6. Joshi and Narasimhan, *Curr. Sci.*, 1940, **9**, 536. 7. Joshi and Deshmukh, *Nature*, 1941, **147**, 809. 8. Elster and Geitel, *Phys. Zeit.*, 1913, 14, 741. 9. Joshi and Deo, *Nature*, 1943, **151**, 561. 10. —, *Curr. Sci.*, 1943, **11**, 306. 11. Deo, *Sci. and Culture*, 1943, **9**, 252. 12. Halban and Siedentoff, *Z. Phys. Chem.*, 1922, **103**, 71. 13. Elliot, *Proc. Roy. Soc.*, 1929, **A 123**, 629.

INFLUENCE OF EXCHANGEABLE IONS ON THE DISPERSION OF SOIL*

THE problem of stability of soil colloids unlike that of purer colloids is complicated because their suspensions are polydispersed systems. In clay systems both inorganic and organic constituents show pronounced base exchange properties, while their composition and structure are uncertain. Numerous attempts, in the past, have been made to study the coagulation of clay colloids by addition of electrolytes, but all the factors affecting the stability of colloidal suspensions have not yet been elucidated.

It is known that soils when saturated with monovalent exchangeable cation get dispersed due to "auto-disintegration". This dispersion is facilitated by a slightly alkaline medium. In the first series of experiments described here the dispersion of a pure calcium soil was studied when it was treated with increasing quantities of carbonates of sodium, potassium and ammonium.

The colloidal material was separated from a soil by decanting a suspension of sodium soil which had been kept standing for 24 hours. From this were prepared respectively pure calcium, sodium, ammonium and potassium clays, by the usual method of leaching with normal solutions of the respective chlorides and removing the excess salts by washing with alcohol.

10 gm. samples of pure calcium clay were shaken with increasing quantities of the carbonates of Na, NH_4 and K in a stoppered cylinder with 500 c.c. of water. The resulting suspension was subjected to pipette analysis as is done in the mechanical analysis of soils. 20 c.c. of the suspension were pipetted out from fixed depths after definite intervals of time. It was coagulated by adding $CaCl_2$ and filtered. The residue was converted into calcium clay by leaching with calcium chloride, washed, dried and weighed. The weight of residue multiplied by 250 gave the amount of clay dispersed from 100 gms. of Ca-soil obtained by the treatment with carbonates of alkali metals. If this weight be denoted by C', the 'dispersion coefficient' D is given by:

$$D = \frac{C'}{C} \times 100,$$

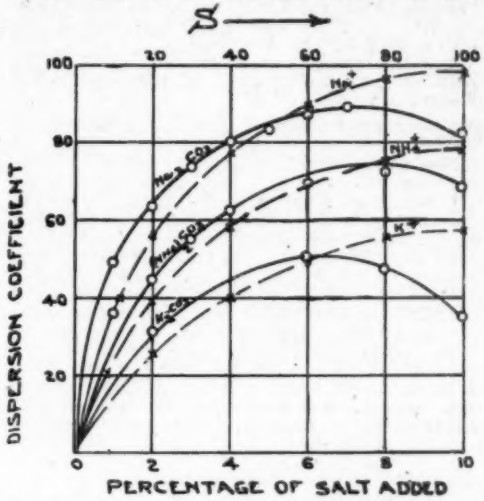
where C is the clay content of the original Ca-clay.

The 'dispersion coefficients' as found by adding different quantities of the carbonates of the alkali metals are plotted and full line curves drawn through them.

In the experiments described above, the dispersion was affected by the presence of excess free salts. Experiments were, therefore, repeated by employing mixtures of pure calcium and alkali soils in suitable proportions. It was found that in these experiments the values of D were related to S, the per cent. of alkali clay by a power relation of type

$$D = mS^k \quad (m \text{ and } k \text{ being constants}) \qquad (1)$$

The variation of 'D' with 'S' is shown by broken lines in the graph. The resemblance between the initial parts of the two sets of curves indicates that the dispersion of soil colloids produced by shaking Ca-soil with the carbonates of alkali metals is due to the gradual replacement of exchangeable calcium by alkali cation. But as the concentration of the free



salt increases in the dispersion medium the alkali cations tend to coagulate the soil by compressing the double layer surrounding the dispersed particles.[2] This is why continuous curves are characterised by definite maxima.

The broken lines in the graph refer to the 'oriented dispersion' of clay particles—a term introduced by Marshall[3] for the stability of colloidal suspension due to the modification of the double layer on account of base exchange. It is clear from these curves that the effect of the three ions on the 'oriented dispersion' of clay particles is in the order:

$$Na > NH_4 > K$$

which is the same as the order of impermeability.[4]

Chemistry Department,
Lucknow University,
Lucknow, K. P. SHUKLA.
August 11, 1943.

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NUTRITIONAL REQUIREMENTS OF *L. BULGARICUS, L. ACIDOPHILUS* AND *STREPTOCOCCUS LACTIS*

DURING recent years microbiological methods have come into prominence in the estimation of vitamins of the B group. These methods are simple, rapidly reproducible and require only minute amounts of test materials for assay

purposes. The most commonly used organisms are the lactic acid bacteria. The nutritional requirements of certain strains have been studied by various workers.[1–9] The present investigation relates to the study of the nutritional requirements of three strains of lactic acid bacteria, namely, *L. bulgaricus*, *L. acidophilus* and *Streptococcus lactis*, which hitherto have not received much attention.

The basal medium for these studies contained alkali-treated photolysed peptone, casein hydrolysate, hydrolysed nucleic acid (as a source of purine and pyrimidine bases), cystine, glucose and sodium acetate. The different vitamin solutions used were prepared from crystalline materials, except biotin, which was prepared in the laboratory according to the method of Snell and Wright.[10] The basal medium was brought to pH 6·8, 5 c.c. were added to each tube along with 1 μg. of each of the different vitamins, and the volume was made upto 10 c.c. After sterilization for 15 minutes at 15 lbs. pressure the tubes were inoculated with washed suspensions of the cultures, incubated at 37° C. for 72 hours and the amount of lactic acid produced was determined by titration with 0·1 N sodium hydroxide. The results are presented in Table I.

TABLE I

	Cc. O.I.N. lactic acid produced per 10 c.c. medium		
	Streptococcus lactis	*L. bulgaricus*	*L. acidophilus*
1. Medium (M) + no vitamins	1·2	0·4	2·0
2. M + vits. B_1, riboflavin (r), B_6, nicotinic acid (N.A.), pantothenic acid (P.A.) and biotin	5·0	9·5	9·4
3. M + vits. B_1, r, B_6, P.A. and biotin	4·9	9·4	9·4
4. M + vits. B_1, r, P.A, N.A, and biotin	5·0	9·3	9·7
5. M + vits. B_1, r, B_6, N.A. and biotin	1·4	0·4	2·3
6. M + vits. B_1, r, B_6, N.A. and P.A.	5·1	9·4	9·4
7. M + vits. r, B_6, N.A., P.A. and biotin	5·3	9·5	9·6
8. M + vits. B_1, B_6, N.A., P.A. and biotin	2·1	1·7	2·3

It is clear from the above table that the three strains of lactic acid bacteria used in this investigation require only pantothenic acid and riboflavin for growth. Snell[11] reported that vitamin B_6 is required by *Streptococcus lactis* R. We have, however, been unable to detect any stimulating action of this vitamin on our strain.

Landy *et al.*[2,13] in their investigation on the relation between avidin and the biotin requirements of, and acid synthesis in, micro-organisms, observed that the growth of organisms which required biotin in the culture medium was inhibited by avidin, whereas avidin had no effect on organisms capable of synthesising biotin. In view of these observations, the effect of avidin on these three strains was investigated. Avidin was prepared and tested as recommended by Eakin *et al.*[14] The results are incorporated in Table II.

TABLE II

Inactivation of Biotin by Avidin

	Cc. O.I.N. lactic acid produced per 10 c.c. medium					
	Streptococcus lactis		*L. bulgaricus*		*L. acidophilus*	
	Unheated	Heated	Unheated	Heated	Unheated	Heated
1. Medium (M) + vits. B_1 riboflavin (r), B_6, P.A. N.A. and biotin	—	5·2	—	9·5	—	9·4
2. M + vits. B_1, r, B_6, P.A. and N.A.	—	5·2	—	9·5	—	9·5
3. M + vits. B_1, r, B_6, P.A., N.A. and biotin + avidin	2·0	5·2	0·8	9·5	2·1	9·5
4. M + vits. B_1, r, B_6, P.A. and N.A. + avidin	1·4	5·2	0·6	9·5	1·4	9·5

The results show that *L. bulgaricus*, *L. acidophilus* and *streptococcus lactis* require biotin and that the basal medium contained enough biotin to promote growth of these organisms.

Attempts are now being made to estimate pantothenic acid and riboflavin employing one of these strains, particularly *L. bulgaricus*, since this organism gave the lowest blank and highest titration values.

Our thanks are due to The National Collection of Type Cultures, India, Indian Institute of Science, Bangalore, from whom the cultures used in this investigation were obtained.

Nutrition Research Laboratories,
Indian Research Fund Association,
Coonoor, KAMALA BHAGVAT.
February 8, 1944. NIRANJAN SINGH SEKHON.

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EFFECT OF VANADIUM ON YEAST CELLS

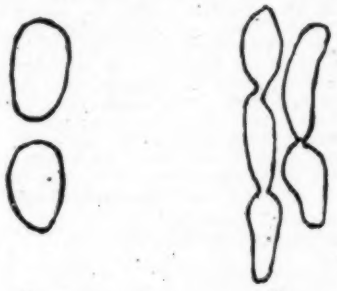
It is generally known that the Saccharomycetes sporulate only under certain specific conditions. Henrici[1] gives details of the conditions under which the different species and strains of Saccharomycetes can be expected to form ascospores and also adds, "Spore formation with yeasts is always uncertain".

In an attempt to analyse the factors involved in sporulation, experiments were made to find if any 'trace elements' were involved. Trials were made on the effect of traces of vanadium pentoxide in the culture media in which the yeasts were grown. The experiments were made with three pure strains of *Saccharomyces cerevisiæ* isolated from Brewers' yeast.

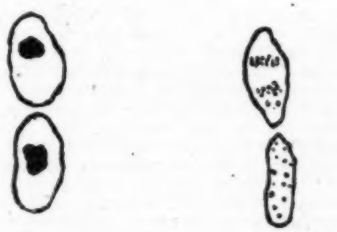
The few experiments conducted gave no decisive result. Results varied with the modes of application, temperatures of cultivation and strains of the yeast. Generally, concentration of one part in one thousand of vanadium pentoxide inhibited sporulation and that of one part in two thousand favoured sporulation.

The vanadium present in the medium in the above concentrations had other effects also.

The vegetative cells of *S. cerevisiæ* became elongated, becoming ellipsoidal, club-shaped or filamentous, in the course of a week in wort-agar slants. This is illustrated by the comparison of Figs. 1*a* and 1*b*. The main vacuole



1*a* Normal cells — 1*b* V. treated cells



2*a* Normal cells — 2*b* V. treated cells

or the 'volutin body' developed earlier and attained greater size than in untreated cultures. The structure of the fat granules in the cells was altered. These bodies arise as small refractile granules in three-day-old wort-agar slants, in both treated and untreated cultures. In normal cultures these bodies later coalesce and occupy the central space in majority of the old cells. In Vanadianised cultures these bodies never coalesce, but become distributed along the periphery of the cells. This is illustrated by Figs. 2*a* and 2*b*. In old cultures the vanadianised cultures take up a dark-brown colour, contrasting with pale yellow of untreated cultures. Vanadium favours the formation of vegetative spores or 'Dauer-Zellen'. Such spores are formed in most old cultures and are considered comparable to chlamydospores (Guilliermond[2]). Those spores formed in the presence of vanadium have fat granules distributed on the cell-wall. They germinate freely, after a slight delay, in wort-agar slants.

All these effects were quantitative and not qualitative. The effect lasts only as long as the vanadium is present in the environment, and the cells revert to normal in normal wort.

Section of Fermentation Technology,
Indian Institute of Science,
Bangalore, S. Sampath.
February 2, 1944.

1. Arthur T. Henrici, "Molds, Yeasts and Actinomycetes," New York, 1930. 2. Guilliermond, "The Yeasts," Transl. by F. W. Tanner, New York, 1920.

CATALYSIS OF THE REACTION BETWEEN DICHROMATE AND AROMATIC AMINES BY THE OXALATE ION

It has been previously reported that oxalate catalyses the reaction between dichromate and hydriodic acid[1] and dichromate and hydrobromic acid.[2] We have now found that oxalate markedly accelerates the reaction of a number of aromatic amines with dichromate in the presence of dilute sulphuric acid. The phenomenon has been studied by noting the time required for the appearance of the characteristic colour on reaction with dichromate in the presence and absence of oxalate. For example, about 25 ml. of a very dilute solution of potassium dichromate (N/2500) was taken in a clean beaker and 0·3 ml. of a 0·01 per cent. solution of diphenylamine in concentrated sulphuric acid was stirred in quickly; a stop-watch was started simultaneously and the time required for the appearance of the blue violet colour was noted. In the absence of oxalate it took five minutes for the blue violet colour to appear, whereas when 1 ml. of N/5 sodium oxalate was added (under otherwise identical conditions) the blue violet colour was immediately produced. The results with the amines experimented with are recorded in Table I.

All substances under test are dissolved in concentrated sulphuric acid, and a known volume of the solution treated with 1 c.c. of a decinormal solution of potassium dichromate and a requisite amount of water to bring up the volume of the reaction mixture to a total of 25 c.c.

TABLE I

Substance	Quantity and concentration of the test solution	Observations	
		Without oxalate	With oxalate (overall concentration 0·02 N)
Aniline	0·5 ml. of a 0·1% solution	Green precipitate in 20 minutes	Green precipitate in 5 minutes
o–toluidine	0·5 ml. of a 5% solution	No colour change even in 20 minutes	Immediate orange brown colour turning grey in five minutes
p–toluidine	2·0 ml. of a 0·1% solution	No colour change even in 15 minutes	Red brown colour in 2 minutes
m–toluidine	0·5 ml. of a 5% solution	No colour change even in 30 minutes	Ruby Red colour in one and half minutes
α-naphthylamine	2·0 ml. of a 0·1% solution	Brown colour in 10 minutes	Deep Ruby colour almost immediately
Diphenylamine	0·3 ml. of a 0·01% solution	Blue violet in 5 minutes	Blue violet almost immediately oxalate concn. (N/125)
Dimethylaniline	0·1 ml. of a 5% solution	No colour change even in 20 minutes	Orange colour in half a minute
Tetramethyl diamido-diphenyl methane	0·5 ml. of a 0·1% solution	No colour change even in 30 minutes	Orange colour immediately

Chemical Laboratories,
Andhra University, C. R. VISVANADHAM.
December 23, 1943. G. GOPALA RAO.

1 C. R. Viswanadham and G. Gopala Rao, *Curr. Sci.*, 1942, **11**, 102. 2. —, *Ibid.*, 1943, **12**, 186.

BALUCHISTAN SULPHUR FOR JOWAR SMUT

SULPHUR is one of the most widely used fungicides against crop diseases. Its supply, which is mainly from abroad, has become extremely difficult due to war and this is working as a great handicap against its free use as a fungicide. Fortunately India possesses a big store of it in the Baluchistan sulphur mines, where it occurs in crude form in lumps and has to be ground finely before use. Its purity has been found to be about 56 per cent. Its use as a seed-dressing against jowar smut [*Sphacelotheca sorghi*. (Link) Clinton] has been found to be very efficacious as seen from the details of an experiment done at the Gwalior Central Farm in 1943.

Four seers (8 lbs.) of jowar seed were dusted with the smut spores and well mixed in by rubbing the grains between the hands. They were then divided into three equal lots. One lot was treated with finely ground Baluchistan sulphur which had passed through a sieve a little finer than 100-mesh, the second was treated with commercial flowers of sulphur of 200-mesh fineness; and the third was used as a control. The quantity of sulphur used for each lot of seed weighing $1^1/_2$ seers was 5 grams, *i.e.*, the rate of dressing was half an ounce (one and a quarter tolas) per four seers. Each lot was sown separately and the infection noted when the crop matured.

Treatment	Sound heads	Smutted heads
Seed infected with spores, then treated with Baluchistan sulphur	7489	Nil
Seed infected with spores, then with pure sulphur	8462	Nil
Seed infected with spores alone, control	6624	2079

It will be noted that Baluchistan sulphur, even of 56 per cent. purity, is as effective as commercial flowers of sulphur of 99 per cent. purify in controlling jowar smut.

Regarding its supply, one should write to the Director, Chemical Directorate, Directorate-General of Supply, Sahajahan Road, New Delhi. It is hoped that other workers will give their experiences with Baluchistan sulphur.

I am grateful to Dr. G. Watts Padwick, Imperial Mycologist, for giving me the information regarding the Baluchistan sulphur.

Govt. Central Farm,
Gwalior Government,
Gwalior, G. S. KULKARNI.
December 16, 1943.

KULKARNI'S NOTE ON BALUCHISTAN SULPHUR

WE are grateful to Mr. G. S. Kulkarni for having been good enough to show us the draft of his note on Baluchistan sulphur. At the Imperial Agricultural Research Institute we have worked with this material for three years but unfortunately in some of our experiments infection was low in the controls. In 1942-43 we experimented with covered smut of barley by treating seed with Baluchistan sulphur of 75 per cent. purity powdered and passed through a 100-mesh sieve. The seed was sown at Karnal and Delhi in replicated plots, and sulphur compared with other treatments. All were used at the dosage 1 : 250 by weight.

The results indicated that Baluchistan sulphur dust is suitable and at least equal to pure sulphur.

As a result of this success, we decided in 1943 to treat 12·5 acres of jowar with the

Baluchistan sulphur dust and leave 11·5 acres untreated.

Treatment	Percentage of smut	
	Delhi	Karnal
Control	1·20	1·44
Pure sulphur	0·08	0·10
Formalin dust (6 per cent. formalin on charcoal dust)	0·00	0·04
Agrosan G.	0·01	0·08
Baluchistan sulphur ..	0·05	0·08

Two different lots of seed were used, one from Rohtak and the other from Karnal, both naturally infested with grain smut spores. The percentages of grain smut in the resulting crops were as follows:

Area in acres	Seed	Treatment	Percentage grain smut
1	Rohtak	Treated	Nil
11·5	Karnal	,,	Nil
11·0	Rohtak	Untreated	9·8
0·5	Karnal	,,	2·1

It will be noted that our sulphur was hand-picked before grinding and so brought up to 75 per cent. sulphur. It is of great interest to us that Kulkarni has obtained comparable results with the unpicked material.

Mycology Section,
Imperial Agricultural Research Institute,
New Delhi,
January 14, 1944.

G. Watts Padwick.
B. B. Mundkur.

NEOVOSSIA INDICA IN CULTURE

During the course of an investigation on the germination of the chlamydospores of *Neovossia indica* (Mitra) Mundkur, the slides on which they were germinating were inverted over the surface of potato agar in petri-dishes and the sporidia allowed to drop on it. Every precaution to avoid contamination was taken. The dishes were incubated at 15° C. for seven days, at the end of which period small white colonies became manifest in most of the dishes. The colonies consisted of thick mats of much branched mycelium and numerous secondary sporidia.

On transfers being made, it was noted that the organism can grow well on potato dextrose agar and in three per cent. malt extract solution. The colonies are white, powdery, brittle, crustaceous, umbonate, with dendritic margins, and spread rather slowly. A temperature of 18° C. has been found to be suitable for their growth. The mycelium coils in a peculiar manner, branching, rebranching and producing secondary sporidia, singly and at intervals. The opposite sides of the test tubes or the upper lids of the petri-dishes, as the case may be, get coated with secondary sporidia which are violently discharged. The secondary sporidia and the mycelium appear to be entirely monocaryotic.

Further cultural studies on the behaviour of these isolations and their ability to infect the host are in progress.

Mycology Section,
Imperial Agricultural Research Institute,
New Delhi,
January 20, 1944.

C. S. Ramamoorthy.
B. B. Mundkur.

DEVELOPMENT OF THE EMBRYO-SAC OF *ZIZYPHUS JUJUBA* LAMK.

The development of the embryo-sac of *Zizyphus sativa* was investigated by Chiarugi (1930) and he found an *Allium*-type of embryo-sac in this species. Srinivasachar (1940), on the other hand, has recently reported the *Normal*-type of embryo-sac in *Z. Jujuba* and *J. œnoplia*. I have reinvestigated the embryo-sac of *Z. Jujuba* and find myself unable to agree with the observations and conclusions of Srinivasachar. Even after examining numerous preparations, I have been unable to observe the formation of a tetrad of megaspores from the megaspore-mother-cell in any case. The megaspore-mother-cell gives rise only to a dyad. Both the dyad cells generally become binucleate, but no cell-walls are laid between these nuclei. The nuclei of the chalazal dyad cell then undergo two more mitotic divisions and form an eight-nucleate embryo-sac. The development of the embryo-sac in *Z. Jujuba*, therefore, is clearly of the *Allium*-type, as reported previously by Chiarugi (1930) in *Z. sativa*.

Another interesting feature of megasporogenesis in *Zizyphus Jujuba* is the very frequent occurrence of multiple embryo-sacs. As many as six or seven embryo-sacs have been observed in one ovule. These generally result from the simultaneous development of several megaspore-mother-cells, but sometimes multiple embryo-sacs also arise from the development of both the dyad cells derived from a single megaspore-mother-cell.

Thanks are due to Dr. A. C. Joshi for his kind interest.

T. N. J. College,
Bhagalpur,
December 20, 1943.

L. B. Kajale.

1. Chiarugi, A., *Nuovo giorn bot. Ital., N. S.*, 1930, **37**, 287–312. 2. Srinivasachar, D., *Proc. Ind. Acad. Sci.*, B, 1940, **11**, 107–16.

A NOTE ON THE STRUCTURE OF THE PETIOLE OF AN ANOMALOUS LEAF OF *HELIANTHUS ANNUUS*, LINN. (COMPOSITÆ)

Transverse sections of the petiole of an abnormal bilobed leaf of *Helianthus annuus* Linn. showed in addition to the normal vascular bundles in an arc, several internal bundles in line with some of the normal ones. In general outline the petiole is dorsoventrally symmetrical at the base, but it becomes gradually radially symmetrical as it reaches the lamina region. Resin ducts are present in the parenchymatous cortex of the abaxial side only. They are arranged in the form of an arc. According to

Haberlandt,[1] in the petiole of Sunflower every vascular bundle is subtended by crescentic group of oil passages, both on its inner and on its outer side. In the present case some of the vascular bundles of the outer arc only are subtended by resin ducts on their outer side only. Structurally the resin ducts consist of seven to eleven secretory cells and one sheathing layer. The number of resin ducts vary from 13 to 19. There is no visible endodermis and pericycle.

There is the usual arc of collateral bundles. Some of them have internal bundles of various ages and sizes. The number of the internal bundles, in association with a normal bundle, may be more than one in some cases. The internal bundles arise from pith cells situated opposite to the protoxylem of the normal bundles and develop into reversed collateral bundles, quite independent of the outer normal bundles. They appear to develop after the normal bundles. They sometimes arise opposite to the medullary rays, or in the medullary rays of the normal arc. In the medullary bundles the position of the xylem and phlœm is not changed as in the internal bundle. These internal bundles are also collateral and show inverse orientation of the xylem and phlœm but some are composed of phlœm or xylem only. The direction in which the protoxylem elements point and the amount of xylem and phlœm formed, vary in different internal bundles. Occasionally two bundles are found touching each other by their xylem or phlœm faces. This gives an impression of a normal bundle with an inversely oriented internal bundle. This may be due to branching of individual bundles and to anastomoses taking place between bundles. The single bundle gradually divides itself into two which then rotate in such a way as to lie opposite to each other and for a short distance touch by their xylem or phlœm faces before becoming entirely separated.

Two types of anomaly in the structure of petiole in general are recorded by Solereder.[2] The occurrence of "rayed bundles" is one; while the other is "true concentric or hemiconcentric bundles". The Compositæ represent one of the natural orders, many members of which exhibit internal or medullary phlœm in their stems. Worsdell[3] in his study of origin and meaning of medullary (intra-xylary) phlœm in stems of dicotyledons has investigated many Comopositæ plants. He found complete absence of medullary strands in the petiole of seven species of Rudbeckia and of Dahlia. Of the tribe Helianthoideæ only in the petiole of *Echinacea purpurea* Moench., he observed the scattered disposition of the bundles. According to Thoday,[4] "in the petiole of a large leaf of Sunflower, there are a number of small bundles, besides the three principal ones. These small bundles appear to anastomose in rather intricate fashion and one or two large ones unite with two lateral bundles. In the base the remainder cluster round the principal bundles as they diverge. Many of the smallest bundles consist, even in the case of a matured leaf, of phlœm only and in others the xylem dies out in the normal region."

The phylogenetic or physiological significance of the internal bundles has been discussed by several authors as Worsdell,[3] Maheshwari and Singh,[5] Wurke,[6] Alexandrov and Alexandrova,[7] and Hartwich.[8] According to Worsdell[3] they represent a vestigial structure, the remnant of a former system. Maheshwari and Singh[5] and Wurke[6] are of opinion that they are of an advanced character, the species with higher chromosomes being generally found to possess them and those with the lower numbers lacking them. Alexandrov and Alexandrova[7] and Hartwich[8] also regard them as derived. It may be quite possible that the extra bundles are developed in response to nutritive demand.

Bahauddin College,
Junagadh, G. A. KAPADIA.
September 21, 1943.

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A PODOSTEMAD FROM KUMAON (CENTRAL HIMALAYAS)

MEMBERS of the family Podostemonaceæ have been recorded in this country from South India, Assam, Eastern Himalayas (*cf.* Hooker[1] and Willis[2]) and recently Haines[3] has described one species (*Lawia zeylanica*) from Orissa. In the Himalayas, there are no records of Podostemonaceæ west of Darjeeling. The collection of a podostemad from Kumaon is thus of interest in connection with the geographical distribution of the family.

The plant was found growing closely attached to large stones in the bed of the Kosi river at Chananda (29·46 N. and 79·38 E.), about 16 miles from Almora and 4,500 feet above the sea-level, in the months of August and September. The exact spot can be located by its situation opposite to the Gandhi Ashram of Chananda. On comparison with the other members of the family, it is seen that this podostemad belongs to the genus *Zeylanidium* Tul., described as a subgenus of *Hydrobryum* Endl. by Willis[2] in his account of the Podostemonaceæ of India and Ceylon. The genus *Zeylanidium* at present includes three species, *Z. olivaceum* (Gardn.) Engl., *Z. lichenoides* (Kurz) Engl. and *Z. Johnsonii* (Wight) Engl. The present material from Kumaon does not appear to agree with any one of these and is to be regarded as a new species.

Rae Bareili, and
Benares Hindu University, M. S. RANDHAWA.
January 15, 1944. A. C. JOSHI.

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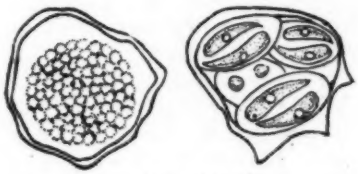
A NEW COCCIDIAN FROM THE INTESTINE OF THE FISH *NOTOPTERUS NOTOPTERUS* (PALLAS)

ON August 5, 1943, Mr. S. P. Basu, Research Assistant of I.C.A.R. Fishery Scheme, Calcutta University, placed at the disposal of the authors some coccidian oöcysts obtained from the intestine of the fish *Notopterus notopterus* (Pallas), purchased from one of the local markets. The collection of oöcysts included few immature and a large number of mature forms which were identified as belonging to the genus *Eimera*. The few species of this genus that have so far been recorded from Indian fishes are *E. southwelli* Halawani[1] (1930), *E. harpodoni* Setna and Bana[2] (1935) and several unidentified ones by the last named authors. The parasite found by us appears to be new to science and is herein described under the proposed name of *Eimera notopteri* sp. n.

Specific diagnosis: Both the mature and the immature oöcysts are irregular in shape and measure 24·2 μ × 22 μ. The unsegmented zygote within an immature oöcyst (Fig. 1) is



1 2

FIG. 1. An immeture oöcyst × 1660
FIG. 2. A fresh mature oöcyst × 1660

spherical in shape with highly granular cytoplasm and contains several refringent globules. The oöcysts possess a double-layered envelop and are without any micropyle or oöcystic residuum.

The sporocysts (Fig. 2) are oval in shape with both the ends pointed and measure 11 μ × 6·6 μ. They are without any refractile knob or residual mass. The sporozoites are elongated bodies with the anterior end pointed and the posterior rounded. The nucleus is situated at the centre of the sporozoites.

Affinities: Of the known species of *Eimeria* from the cold-blooded vertebrates [*vide* Levine and Becker[3] (1933)], *E. notopteri* sp. n. shows close affinity to *E. ranæ* Dobell[4] (1908) in shape and size but differs from the latter in the absence of oöcystic and sporocystic residuum as well as in the shape of the sporocysts.

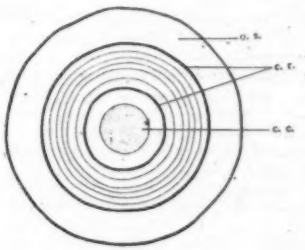
MUKUNDAMURARI CHAKRAVARTY.
AMIYA BHUSAN KAR.
Department of Zoology,
University of Calcutta,
February 4, 1944.

1 Halawani, A. *Ann. Trop. Med. Parasit.*, 1930*a*, **24**, 1-3. 2. Setna, S. B., and Bana, R. H., *J. Roy. Micr. Soc.*, 1935, **55**, 165–69. 3. Levine, N. D., and Becker, E. R., *Iowa. State Coll. J. Sci.*, 1933, **8**, 83–106. 4. Dobell, C., *Proc. Camb. Phil. Soc.*, 1908, **14**, 428.

THE OCCURRENCE OF THE CRYSTALLINE STYLE IN *LAMELLIDENS MARGINALIS* (LAMARCK)

THE common fresh-water mussel *Lamellidens marginalis* is dissected as a type of the Mollusca in most of the zoological laboratories of India, and it is, therefore, necessary to know all the facts about its anatomy. Although the anatomy of this form has been studied by Ghosh,[1] Prashad,[2] and Bloomer,[3] none of these authors seems to have noticed the *crystalline*

FIG. 1. Crystalline Style of *L. marginalis*
h.—head end; *c.c.*—central core; *t.*—tail end (xeir. 2½)



2

FIG. 2

A transverse section of a crystalline style. *o. s.*, outer sheath; *c. r.*, concentric rings formed from the outer part of the central core; *c. c.*, unstratified part of the central core. (xeir. 112).

style within the alimentary canal of this mussel. While working on this type, I found a well-formed *crystalline style*—a structure not commonly demonstrated to students in our laboratories.

The crystalline style of *L. marginalis* is a transparent, more or less elongated, rod-like structure, about 3 to 4·4 cms. in length, and about ·4 to ·75 mm. in diameter in an animal measuring 8 to 9·5 cms. in length. According to Biedermann[4] the crystalline style of *Anodonta* is 7 to 8 cms. long, while Gutheil[5] gives the length as 6 to 7 cms. in an animal 13 to 14 cms. long. Mitra,[6] while describing the crystalline style of *Anodon*, states that it is three-fourths as long as the animal itself.

The style of *L. marginalis* (Fig. 1) is thicker at its anterior than at its posterior end. The anterior end (about 2 mm. in length) lies within the stomach and is bent on itself, while the remainder of the style is contained within

a groove of the first part of the intestine. The bent condition of the anterior end is not shown in the diagrams of the style of *Anodonta grandis* and *Anodon* made by Nelson[7] and Mitra. Since the groove of the intestine in which the style is lodged is an open groove and not a closed "sac", I consider that it is proper to call it "style groove" rather than "style sac".

A freshly formed crystalline style consists of a central core surrounded by a homogeneous sheath, the core being about three-fourths the diameter of the style. But as the style grows, the outer part of the core develops several ring-like concentric layers, leaving only a small, soft, unstratified part in the centre (Fig. 2)..

In mussels which have been out of the river for several hours the crystalline style disappears, but when these very specimens are again kept in an aquarium in the laboratory, it is found that a very long and stout style generally reappears.

Zoology Department,
Lucknow University, PREM VATI GUPTA.
December 3, 1943.

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AN IMPROVED TYPE OF BOTTLE SILT SAMPLER

A BOTTLE SILT SAMPLER was designed in 1934 for collecting suspended silt in channels to study the chief quality characteristics of the transported material, particularly the silt charge and the silt grade, in connection with the Lacey Formulæ for Regime Flow of Channels. But the Bottle silt sampler, being an ordinary container type, has to be opened at the requisite depth of sampling for the minimum time to fill; otherwise the silt concentration increases with the length of time for which it remains open under submergence after it is full.

To overcome this difficulty, the Binkley and Uppal silt samplers were subsequently designed, which consist of hollow metallic cylinders with axis parallel to the flow of stream at the time of sampling. In the case of these samplers, the need of measuring filling time does not arise as the silt-laden water is in continuous flow through them and as soon as the requisite depth of sampling is attained, silt sample is trapped by closing both the ends simultaneously.

But comparatively, the Bottle silt sampler has proved to be superior on account of its handy size, simple construction and ease of working in actual practice. It was, however, necessary to provide it with an *infallible device* to know when it gets filled so that it may be closed instantaneously after it is full.

With this object in view, the Bottle sampler has been fitted in its neck with a make-and-break circuit device (*vide* Fig. 1). As soon as it gets filled, a cork float, carrying a copper plate on its top, rises and completes circuit by touching two copper screw poles, which are connected to an electric bell and dry cells in the observer's boat. Consequently the bell rings and mouth of the Bottle sampler is closed by the observer instantaneously by releasing a spring stopper, which also depresses

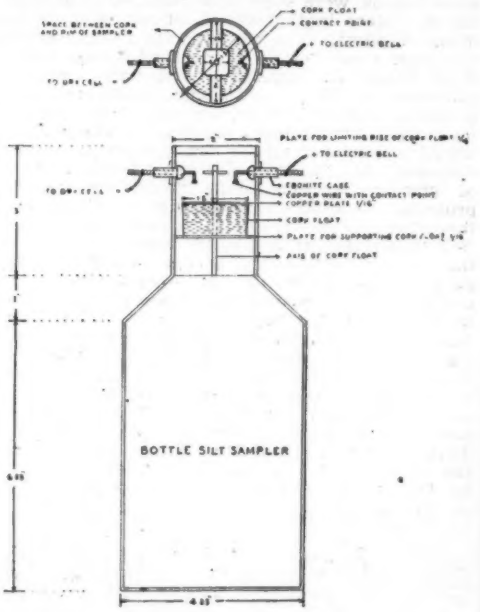

FIG. 1

the float slightly to break the circuit. The sampler is then withdrawn for emptying its contents.

The device has been tried and found to be efficient and useful in the work of silt sampling.

Irrigation Res. Lab.,
Sind P. W. Dept., K. K. FRAMJI.
Karachi, G. S. RAISINGHANI.
December 23, 1943.

Fortier, S., and Blaney, H. F., *Silt in the Colorado River and its Relation to Irrigation*, 1928. Lacey, Gerald, *Stable Channels in Alluvium*, 1930. Taylor, McKenzie, *Punjab Practices in Silt Observations*, 1936; *Bull. No. 13 of the Central Board of Irrigation*, 1939. Raisinghani, G. S., *A Note on an Improved Type of Bottle Silt Sampler*, 1940; *Annual Report of the Work done in the Development and Research Division for the Year ending May 1942*. Thomas, A., D. O. No. 5594-Jr. 115, dated 28th September 1942 to Mr. Framji, 1942. Framji, K. K., D. O. No. D-4, dated 28th November 1942 to Mr. Thomas, 1942.

REVIEWS

A Treatise on Physical Chemistry. Edited by Hugh S. Taylor and Samuel Glasstone. Volume I. Atomistics and Thermodynamics. (Macmillan and Co., Ltd.) Pp. 679. Price 42*sh*.

The first and second editions of this well-known book were very well received and have found a place in the shelves of all serious students of physical chemistry. The third edition has been conceived on a more ambitious scale. Prof. Taylor has secured in this enterprise the collaboration of Prof. Samuel Glasstone as a co-editor and a band of well-known specialists for writing out selected chapters of the treatise which is now intended to be published in five volumes. In the inter-war period, the science of physical chemistry has made remarkable progress. And the editors have rightly felt that there is need for a treatise which will "set forth adequately all the great advances in the science, define the present status of the subject and present to the student the accumulated experience of his predecessors in the work, so that he may go forward to the new field as yet unexplored". In this aim the authors have been eminently successful. The first volume consists of four chapters—chapter I on the atomic concept of matter, and chapter III on the first and second laws of thermodynamics, have been contributed by Professors Taylor and Jones, chapter II on the quantum theory of atomic spectra and atomic structure by Dushman and chapter IV on the third law of thermodynamics and statistical mechanics by Professor Aston.

Each chapter is, as it should be, a self-contained monograph in itself. This has led to some amount of duplication; for example, pages 401-405 of chapter II, dealing with magnetic properties of atoms and ions in relation to spectral type, and pages 627-632 in chapter IV, dealing with magnetic cooling, have much material in common. This decision of the editors not to completely eliminate overlapping in order that the narrative may be continuous and coherent in each chapter will, however, be welcomed by the readers.

The first chapter gives a rapid survey of atomic concepts, periodic classification of elements, properties of the nucleus and the electron, disintegration in radio-active series, and then passes on to a concise but up-to-date treatment of the subject of isotopes and nuclear reactions. A table giving nuclear masses of elements from hydrogen to argon and their isotopes in terms of $0 = 16$, reveals the wonderful accuracy of modern physico-chemical measurements. The newer methods of separation of isotopes by electrolysis and thermal diffusion have been deservedly given special prominence. Almost half the chapter has been devoted to the description of nuclear transformations, and in three informative tables has been summarised our present knowledge of (*a*) type reactions in nuclear transformations, (*b*) stable isotopes of elements and their abundances and (*c*) the essential facts of induced radioactivity, *e.g.*, methods of production of each induced radio-active element, its principal type of radiation, the energy of such radiation and its half life. Such extensive data, it is hoped, will soon be correlated to give us a consistent theory of the mechanism of nuclear processes. The chapter ends with a clear account of the modern work on nuclear fission of uranium into a barium nucleus of mass 139 and a residue of mass ~100 and the subsequent decay of these fission products. Linking up the narration, in appropriate places, have been given the history of the discovery of the fundamental particles—electron, positron, proton and neutron, and their properties; the particulate and wave aspects of matter and the interrelation of mass and energy have also been lightly touched upon. One wishes that a more detailed account were given of the production of positron-electron pairs by annihilation of γ-radiation.

Chapter II covers 318 pages and deals with the spectra and structure of atoms. We have now got elegant books on the subject in the English language—*e.g.*, White's *Introduction to Atomic Spectra*, Candler's *Atomic spectra* and the *Vector Model*. The treatment here appeals more to the physical chemist in that many allied topics have been discussed at considerable length, *e.g.*, photo-electric phenomenon, Compton Effect, Raman Effect, ionising potentials of normal and stripped atoms, thermal excitation and ionisation, metastable states of atoms, collisions of the second kind, life-period of excited states, etc. The important work of Bowen, Grotrian and Edlen who traced the origin of nebulium and coronium lines to forbidden transitions of highly stripped light and medium weight atoms deserved mention in this chapter.

The subject of hyperfine structure of spectral lines has received proper attention. The new experimental technique for such studies, based on the atomic beam and molecular beam resonance method has been described and a theoretical exposition given relating the hyperfine structure to the nuclear spin quantum number and the nuclear magnetic moment of the atom. These magnitudes have been tabulated for some 28 atoms and several interesting conclusions drawn. The section concludes with the following observation: "The presence of negative (nuclear) magnetic moments is another fact of interest in any such theory of binding between protons and neutrons. Bethe and Bacher have pointed out certain relations between values of μ and the structure, but a more explicit theory of the nature of the forces between the two elementary particles is required before it will be possible to account quantitatively for the observed values of nuclear moments."

The last section of the chapter deals with the quantum theory of valency. The principles of quantum mechanics enable one to write down equations for any system of nuclei and electrons which would give all information about the stability and structure of such systems. Such equations are, however, capable of only approximate solutions, but the skilful treatment of Heitler, London and Pauling, have provided us with a truer understanding of the valency

rules which the chemists have developed by codification of their experimental observations. Thus the directed covalent bond, the tetrahedral orientation of the valencies of the carbon atom, and the octahedral configuration of cobaltamine complexes find ready explanation in the preference of P orbitals for particular directions, in the hybridisation of *s* and *p* orbitals, and in the combination of two *d* orbitals with *s* and *p*. The chapter concludes with a very short section on the concept of resonance energy; in view of the importance which it is rapidly gaining, this subject might have been treated at greater length.

The chapter on the first and second law of thermodynamics brings out the significance of information gained by the increasing accuracy of thermochemical measurements. The investigations of Rossini in the National Bureau of Standards and the compilation by him of the best self-consistent values for the heats of formation of chemical compounds have created a new interest in the subject. The sections on (*a*) partial molal quantities, (*b*) the statistical nature of the second law and (*c*) the correlation of partition function with internal energy, heat capacity, equilibrium constant, free energy and gas pressure, have adequately dealt with the new ideas in the field.

The equilibrium constant of a chemical reaction can be calculated from calorimetric measurements if the entropy change can be evaluated. In his famous Heat Theorem, Nernst assumed that the entropy per gram atom for condensed systems is the same at absolute zero and that rate of variation of heat capacity with temperature in the neighbourhood of absolute zero approached zero asymptotically. The quantum theory and the relation of entropy to probability support this theorem; and the third law states that the entropy of all perfect crystals is zero at the absolute zero, while their heat capacities vary in the way postulated by Nernst. In the fourth chapter, four methods have been described to check the validity of the third law and values of ionic entropies based on this law given in a tabulated form. The classical Maxwell Boltzmann Distribution Law and the quantum modifications introduced by Einstein-Bose and Fermi-Dirac have been fully discussed. Many examples have been given of agreement between entropies of rigid polyatomic molecules calculated from spectroscopic and molecular data with those obtained from calorimetric data down to low temperatures. The modification necessary to account for the behaviour of non-rigid polyatomic molecules are then described and the potentials hindering internal rotation evaluated. The determination of such potentials is shown to be very useful for calculating the equilibrium constants of several technical gas reactions, *e.g.*, the syntheses of methyl alcohol from carbon monoxide and hydrogen or the dehydrogenation of isopropyl alcohol to acetone. The chapter ends with three well-written sections on the calculation of chemical constants, the heat capacity of solids and magnetic cooling at low temperatures. The book is remarkably free from printing mistakes, but one cannot help noticing a mistake in the second vertical column of Table XIX on page 626 where "acoustical C_v Debye" should be acoustical C_v Debye".

The first volume has fulfilled the high expectations which the authors have raised and it is hoped that the succeeding volumes will maintain this high standard. J. C. GHOSH.

Annual Review of Biochemical and Allied Research in India, Vol. XIII for 1942. (Society of Biological Chemists, India, Bangalore), December 1943. Pp. 1-91, with an Author and a Subject Index. Price Rs. 3 or 6*sh*.

This *Annual Review* for 1942, the thirteenth of the series, covers, as usual, the entire field of work carried out in India and by Indians abroad, as could be judged from the numerous sections comprising enzymes, vitamins, general nutrition, human physiology, animal nutrition, protein, fat, carbohydrate and mineral metabolism, pharmacology, human pathology, plant physiology, chemistry of plant products and soils and fertilisers. One misses badly that familiar and important section, microbiology and fermentation. It would be difficult to believe that no work was done in this branch in India during the period under review. Due to war? Perhaps yes, for, the sum-total of work judged from the number of pages making the current review is far less than the collection offered as in 1939 by the Society. Be that as it may, research workers in India, and Indians overseas owe a deep debt of gratitude to the Society of Biological Chemists for bringing out this useful summary of literature year after year.

Now to a little setting of the house in order. A few themes have made their appearance, no doubt differently clothed, each time, in more than one section, while certain sections discuss theses not wholly relevant. Thus it is difficult to appreciate the prominent inclusion of the subject, freezing point as a method of detecting the adulteration of milk, in the chapter on "animal nutrition" whatever the interpretation of the term 'animal'. Perhaps the editors could help in future to remedy these remediable defects, as also endeavour to bring out the review not much long after the close of the year to which the review relates. This would save for the editors some very embarassing situations. How would they relish, for example, reading in the beginning of the year 1944, in the *Annual Review* for 1942, published by them in December 1943, an advertisement forewarning that the *Indian Medical Research Memoirs* volume for 1943 will contain only two instead of the usual four numbers!

S. N.

The Genetics of the Mouse. By Hans Grüneberg. (Cambridge University Press, London), 1943. Pp. xii + 412. Price 30/- net.

The mouse, the familiar rodent, has been the subject of two important scientific monographs in recent years. The staff of the Roscoe B. Jackson Memorial Laboratory have published *Biology of the Laboratory Mouse* dealing on all aspects of the normal mouse. The present volume under review, is the second one on a specialised aspect of the mouse, namely, on its genetics.

The mouse has been a favourite animal for varied biological experimentation for the last many years. The science of genetics has in the mouse an unique experimental animal in that "the main contribution of the study of the mouse to the knowledge of genetics as a whole lies in the field of developmental genetics. The anatomy, embryology, physiology and pathology of the mouse is similar to that of man and in studying aberrations in the mouse, we enjoy the immense advantage of being able to utilise the whole body of knowledge about medicine in the widest sense as an ancillary science: in their turn the inherited variations of the mouse constitute an almost untapped source of information for the numerous questions in physiology and pathology."

Apart from introductory chapters such as on taxonomy, reproduction and growth, etc., the main body of the book is divided into three chapters, namely, the "inherited differences", "chromosomal inheritance", and "induced genetic changes". The book concludes with appendices containing a short chapter on "the genetics of cancer in mice" by Drs. C. C. Little and P. A. Gorec and a short note on "the keeping and breeding of mice for genetical experiments". There is an extensive bibliography on all the subjects dealt with in the book, the total references numbering to more than thousand original papers. There are the usual author and subject indices also. The book is throughout illustrated by 43 text-figures and 14 excellent plates. Considering the present conditions the quality in the get-up of the book is quite good.

The chapter on chromosomal inheritance deals with the linkage relationship of all the known genes. The chief point that is to be noted in this connection is that "at least twelve out of the nineteen autosomes are now labelled with one or more genes" and with more knowledge accumulating this number may be raised shortly to sixteen. The chapter on the inherited differences, by far the biggest in the book, occupying nearly 250 pages, treats exhaustively of the origin, genetics, the phenotypic expression in the individual, and most important of all with the "mechanism of gene action" through the study of the development and patho-physiology of the individual mouse. Within the compass of this chapter no less than 79 "qualitative" differences affecting every conceivable organ of the mouse such as the integument, the endocrines, the sense organs and the brain, the blood-forming organs and the blood, the skeleton, the alimentary tract, the urogenital organs, etc.; and no less than 16 "quantitative" differences, such as serological differences, differences in disease resistance and in behaviour are treated concisely, clearly and most interestingly. From the big array of phenomena, the reviewer finds it difficult to select particular topics. However, the sections dealing with the Piebald Spotting, Pituitary Dwarfism, Psudencephaly, Myelencephalic Blebs, Macrocytic Anæmia, Siderocyte Anæmia, Grey-lethal, the short-tail (Brachyury) series, etc., are only random selections from the book which the reviewer read with extreme interest. Lack of space prohibits anything like an adequately complete review of this extremely important fact-crammed book. But by choosing a typical example, one may attempt to give an idea of the treatment of the subject throughout the book.

Let us consider the gene that brings about the remarkable Myelencephalic Blebs in the embryonic mice inheriting the gene in homozygous condition. The gene is considered under the following sections: origin, genetics, description and embryology. We read under the first section that the gene arose during the course of certain X-ray experiments on a heterozygous stock of mice in Little and Bagg's Laboratory in 1923. But, however, evidences show that this was not a true X-ray mutant, but only that it was already present in the heterozygous stock in a recessive state. On becoming homozygous in an individual it brought about the various eye and foot anomalies. Under the section genetics we read about the intriguing behaviour of the gene during planned breeding tests. One thing is only straightforward in all the variety of genetical data, namely, the recessive nature of the gene when outcrossed to unrelated normal mice. But in back-crosses and F_2 matings we observe the extremely disturbed numbers from those expected on either 1:1 or 1:3 expectation. Further, we observe the surprising occurrence of a large number of spurious (for, they are only normal overlaps) normals when homozygous recessives are mated *inter se*. Next we read that selection in homozygous lines can bring about remarkable shifts in the percentage of abnormals and in case of selection for foot anomalies the selection not only influences the incidence of the anomalies but also to some extent the localisation of these defects predominantly in the front limbs or in the hind limbs. The last surprise we have as we proceed in our study is that it is possible to select for strains with many eye defects and practically no foot defects, but not *vice versa*. Now, indeed, the genetic and anatomical situation is very complex,—"a task", if one had not the next section to read, "beyond the imagination of most investigators". As a matter of fact, it is almost the rule throughout the book that we get a revealing insight into the purely genetical phenomena only on reading the developmental and patho-physiological aspect of the case. Indeed, this forms the unique feature of the mouse genetics of which Myelencephalic Blebs afford an extreme example, "one of the most thrilling episodes in the history of genetics", where the embryology has with a bang disclosed completely the very complex nature of the genetical situation. The reviewer has great pleasure in quoting the following for it represents the lucid style of the author of the book as well as completes the story of Myelencephalic Blebs:—"Here, then, is the whole story. A normal process, the oozing of cerebro-spinal fluid through the foramen anterius of the fourth ventricle, is exaggerated. The blebs so produced are guided by purely mechanical forces along the curvatures of the body to their resting places, where they are eventually absorbed, but not before they have mechanically interfered with differentiating organs, in whose neighbourhood they may happen to lie. The distribution of the blebs is conditioned by the surface relief of the embryo, and genetic factors influencing the surface relief of the embryo secondarily influence the path which the blebs take."

In this very inadequate review one cannot close without referring to the literary aspect of the book. In a monograph of this nature where the author is forced to compress the vast material to the maximum limit, he can ill afford space for unnecessary digressions. But yet how appropriate and well-fitted are certain of the remarks scattered through the book. Here are a few examples. Discussing the waltzing mouse the author has a dig at our fair sex. "Females seem to be more persistent dancers than males, a parallel perhaps, to observations in human ball-rooms." Describing the expression of the gene Waved—1, the author writes, "the waviness in the earlier life looks as though the animals had been to the hair-dresser and had a permanent wave treatment". Discussing the colour genes the author says, "there are 2,755,620 possible different genotypes for coat colour. One cannot predict how many visibly different phenotypes correspond to this vast number"—a sentence over which Walt Disney may well contemplate!

By way of criticism the reviewer can say trivially little. He has found only two printing errors in the entire book: one, on page 139 where an 'o' in an 'of' has been omitted and on page 332, 'c' instead of 'e' has been committed to read 'case' instead of 'ease'. The style of necessity must be concise and hence, terse. But this is not unduly the case in the book except perhaps in the sections dealing with coat colour genes. A reproduction from the *Journal of Heredity* of the list of mutant genes and their recommended symbols as an appendix would have been desirable. Lastly, a few coloured plates of mice phenotypes due to few important colour genes might be included when the next edition comes out.

The book needs no recommendation to the professional geneticist. It is assuredly a 'must' item in his shelf. The book is of equal importance to the embryologist, anatomist, physiologist, pathologist and biochemist. It is a pity that few will have the opportunity of having an academic training such as our able author has, namely, in medicine as well as in genetics, and this is likely to make the very important knowledge contained in this book not easily intelligible to many. But this must not come in the way of the class of workers enumerated above making a serious study of the book and profiting immensely thereby. The lay reader in scientific matters if he is prepared for a certain amount of stiff reading, may well borrow the book from any accessible scientific library which must surely have a copy of its own.

B. SREENIVASAN.

A Dictionary of the Fungi. By G. C. Ainsworth and G. R. Bisby. (Imperial Mycological Institute, Kew, Surrey), 1943. Pp. viii + 359. Price 20*sh.* net.

This little book will be to the fungi what Willis's *Dictionary of the Flowering Plants and Ferns* has been to the higher plants. All the genera in use to the end of 1939 are stated to have been listed and their systematic position, present status, together with the probable distribution and the number of species comprising each genus, are given. Short accounts of orders, families, etc., definitions of mycological terms and common and scientific names of important fungi, are also included. In Willis's book there are brief notes on several important genera and the accounts of the families are more detailed. The value of this *Dictionary* would have been enhanced if the same practice had been followed. Martin's key to the families of fungi and line drawings to illustrate important genera are given at the end of the book.

The reviewer did not find the genera *Ægertiella* and *Agaricites* (fossil) mentioned and there may be others likewise which the authors must have omitted for good reasons. Their views regarding synonymy may not be acceptable to every one, so they caution, "the wise reader will not take these, or the synonymy, to be true". It is now known that Jackson's *Allopuccinia* is an obligate synonym of Sydow's *Soratæa* but the authors accept both these genera without any comment. The authors reject Thom's plea for using the name *Aspergillus* for the perfect state and retain *Eurotium* for it and *Oidiopsis* is wisely retained in the Moniliales, the perfect state of that fungus being called *Leveillula*. A list of the authors of genera and species is given on pp. 26-29 but some important names like Bose, Chupp, Clinton, Dastur, J. J. Davis, Garrett, Hiratsuka (father and son), Long, Overholts, Schellenberg, Thom, etc., are missing. Biographical notes of ten mycologists are given but one would have liked to know something about Brocme, Corda, Jacjewski, Leveille, Rabenhorst, Ravenel, Rostrup, Schroeter, Thaxter, Winter and others. There are not many printing errors but on page 6, line 1, 'Corde' is evidently a misprint for 'Corda'; on page 242, line 38, 'Far.' for 'For.'; and on page 322, '*Xylosporium*' for '*Xylosorium*'. Indian mycological work is as usual completely blacked out though Indian Mycologists have made several important contributions to mycology and India contributes handsomely to the income of the Imperial Mycological Institute which has sponsored this otherwise useful and interesting book.

M.

District Industrialisation Drive. By Sir M. Visvesvaraya. (All-India Manufacturers' Organisation, Bombay), 1943. Pp. 44. Price Re. 1.

Most progressive countries owe their comparative prosperous position to their supremacy as an industrial nation. Industries are necessary for any high level of income, they are necessary for the manufacture of Defence machinery, and they are indispensable for civilised existence. And yet it is industries that have suffered particularly neglect in India for many generations. Therefore in any movement towards progress at the present time in India, industries rightly handled, may be expected to give the highest income for the money and energy put into them. In this brochure by Sir M. Visvesvaraya issued by the All-India Manufacturers' Organisation, detailed constructive suggestions are given for organising production by industries in rural areas through formation of Village Group Committees, District Councils, City Councils, etc. The industries considered are principally the small-scale or lighter variety, such as connected with food, clothing and housing

It is hoped that if modern scientific business and mass production methods are even partially applied to economic reconstruction, production of commodities in this country can be easily doubled, and income more than doubled in less than seven years. A study of the distribution of national income according to occupations shows that in India, the income from industries is about one-fifth of that from agriculture, while the reverse is the position in the United Kingdom and Sweden. In the one case it is also poverty, in the other prosperity.

A study of the brochure should infuse enthusiasm and give practical suggestions for all those who are interested in the rapid promotion of industries and industrial pursuits in Rural areas. M. A. G.

Control of the Indian Electricity Supply Industry. By K. V. Karantha. (Published by the author, Post Box 156, Madras), 1944. Pp. 58. Price Annas 12.

In this booklet the author discusses the important question of the choice of agency for the management of electric supply undertakings in India and expresses the view that private enterprise is the best for controlling the industry as compared with Government or Municipal control. He further points out some of the defects of the private enterprise system and for remedy suggests the formation of an electricity board for each province entrusted with the work of rationalisation of license areas and rationalisation of electricity rates.

The booklet also contains, for purposes of comparison, a brief survey of certain aspects of electric supply work in other countries such as U.S.A., New Zealand, U.S.S.R., and Great Britain.

The subject-matter of the booklet is one of considerable importance as it has a direct bearing on post-war development and the views set out by the author as a result of his wide experience of the electricity supply industry in the Madras Presidency, would be indeed very valuable in any planning, to ensure electricity supply in the most efficient manner.

H. N. R.

COLD DENSE-MATTER*

FROM the dawn of Science, natural philosophers have speculated on the atomistic structure of matter, but it was only after the formulation of Newtonian mechanics and developments in analytical dynamics that the atomic concept proved fruitful in interpreting and analysing the physical properties of matter in bulk in terms of the properties of constituent atoms and the laws of interaction between them. It marked a great advance, when, on the one hand, Drude, Lorentz and Richardson amongst others recognised explicitly that the general laws of the 'classical kinetic theory of gases' discovered by Maxwell and Boltzmann could be extended to sub-atomic particles, *e.g.*, the electrons, and, on the other hand, when Einstein and others applied them to particles of more 'usual' size than gas molecules, *e.g.*, colloid suspensions. However, this extension of classical statistical mechanics to electrons led in many cases to serious difficulties and contradictions. The situation was changed when in 1926 Fermi, and independently Dirac, found that classical statistics was inconsistent with Pauli's exclusion principle, the electrons obeying a new statistics called Fermi-Dirac. On the other hand photons and alpha-particles obey what is called Bose-Einstein statistics, after Bose, who first in 1926 formulated it in connection with photons, and Einstein who applied it to material particles. The statistics, Fermi-Dirac or Bose-Einstein, that a particle (or a system) obeys is determined by its spin. Particles which possess zero or integral units of spin (the unit being $\hbar$) obey Bost-Einstein statistics, whereas particles possessing half-integral units of spin obey Fermi-Dirac statistics.

The new statistics has proved fruitful in the understanding of atomic phenomena of the most diverse kinds. In the case of a gaseous assembly of similar particles, for high temperatures or low enough concentrations, the new statistics tends to the classical one, whereas, when the temperature is low or the concentration high there is a wide divergence from classical result. These two limiting cases of the new statistics are called non-degenerate and degenerate respectively. In a non-degenerate (*i.e.*, classical) gas the pressure depends upon the product of the temperature and the concentration, whereas in degeneracy the pressure is (almost) independent of the temperature for a Fermi-Dirac gas, and independent of the concentration for a Bose-Einstein gas, *i.e.*, one of the variables, temperature or volume is relegated to the background.

The first astrophysical application of Fermi-Dirac statistics was made by Fowler, and this was followed by the work of Frenkel, Majumdar and Stoner amongst others. Milne has incorporated the new statistics in his extensive investigations on stellar structure, and the application of its relativistic modification to equilibrium configurations of white dwarfs has been worked out in complete detail by Chandrasekhar.

In Bose-Einstein degeneracy the particles in the assembly are distributed between two phases, the so-called condensed phase and the energetic phase—these two phases are co-extensive in (ordinary) space but separated in momentum space. The condensed phase is constituted by particles that are in the state of lowest kinetic energy possible for a particle in the assembly.

It is interesting to note that in the theory of liquid structure where a liquid is regarded as a continuous medium, permeated with "holes", which presumably obey Bose-Einstein statistics,

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* Summary of Presidential Address delivered by Prof. ~~D. D. Kosambi~~, before the Section of "Physics" at the Indian Science Congress, held at Delhi last January.

D. S. Kothari

the holes can constitute a condensed phase. For the hole-model of a liquid it is of great importance to construct formally the Schrödinger equation and determine the eigenvalues for its energy. The energy levels are found to be discrete, and the theory gives expressions for melting point and latent heat of fusion in terms of the surface tension of the liquids. It is tempting to observe that the energy levels of a hole may reveal their presence in scattering and ultrasonic phenomena.

After describing some properties of blackbody radiation and the transformation of matter into radiation, the properties and astrophysical applications of degenerate matter are dealt with. Degenerate matter is material which is composed of ionised atoms, the free electrons constituting a degenerate gas in the sense of Fermi-Dirac statistics. The question arises 'how and under what conditions atoms become ionized and generate a gas of free electrons?' There are two ways in which atoms become ionized: (1) Temperature ionization and (2) Pressure ionization.

The theory of temperature or thermal ionization was given by Saha about twenty years ago and, if the value of discovery is to be judged by the fruitfulness of its consequences, the discovery of Saha should be regarded as one of the most important in modern physics. In thermal ionization temperature plays a denominating role and pressure and density only a secondary part. In degenerate matter on the other hand the ionization is essentially controlled by the density or pressure—in degeneracy, pressure depends mainly on the density of the material and very little on the temperature.

The theory of pressure ionization finds its most interesting application in explaining the mass-radius relation for white dwarfs and planets. In deriving the mass-radius relation the effect of the electrical field existing inside the configuration is taken into account. The theory predicts that in the white dwarfs stellar material must be completely ionized. In the usual white dwarf theory it is taken as an assumption here it follows naturally from the theory. In the case of planetary masses the degree of ionization depends on the mass and decreases rapidly with falling mass.

It is interesting to observe that for the newly discovered planet (mass $0{\cdot}016\odot$) of the star 61 Cygni, the theory gives a radius of 3×10^9 centimetres if we assume it to be composed entirely of helium. For hydrogen the radius is three times larger.

Perhaps the most significant prediction of the theory is that there cannot be a cold body (planet or white dwarf) appreciably larger in size than Jupiter.

The relativistic modification of the mass-radius relation is also discussed and the treatment given by Kothari is in some respects different from the usual one. The problem of energy generation in white dwarf stars and the question of existence of hydrogen inside them is discussed at length.

TRUTH IN ANTHROPOLOGY*

THERE is very great need of a high standard of Truth in all our field work in Anthropology for anthropology is regarded with some suspicion in India. The attempt of certain scholars and politicians to classify the abcriginal tribes as non-Hindu created the reasonable impression that the science was being diverted to political and communal ends; the animism of the aboriginals belongs to the Hindu family obviously. But the chief thing that disturbed nationalist opinion in India was the creation of the Excluded and Partially Excluded Areas on the move made by a distinguished anthropologist. This arrangement has failed to give the tribes the liberty and protection they want and is to be condemned scientifically. Further, most of the published books on Social Anthropology do injustice by writing in a ridiculous strain about India. Really India's aboriginal population is splendid, verile, honest and kindly and is admirable and worthy of preservation. The publications of the Functional School show that these primitive communities are admirable and lovable. The Ethnographical Survey publications were, however, too bureaucratic, superficial and scrappy, while the Census of India published inaccurate notes on curiosities. Both of these depended on information provided by clerks and other untrained persons; the monographs of the Ethnographic Survey had numerous repetitions. This is the reason why India is almost neglected in the general works on Anthropology, which reproduce the opinions of irresponsible writers with political respectability.

In the interests of truth in anthropology, several things may be emphasised. The investigator should spend several years among the people he studies, knowing their language, and putting himself in sympathy with them. This would be easier for Indian enquirers. He should be 'a detective and a magistrate', for the tribes generally conceal many real facts and motives, or professional informants are unreliable and desirous of publicity more than truth. Negative replies are to be suspected, and conclusions should be firmly based on statistics. The evidence of tribal poetry, folksong, story, proverb and riddle is valuable. The publications also should be well printed and illustrated and expert help should be taken in these matters. Very few Indian words should be given in the text and where given, diacritical marks should be avoided as far as possible. Art and poetry are the sisters of science, in the great family of Truth.

A whole world of Indian life and culture is passing away without proper record and it is high time that we do our field work properly with reference to Truth. But the Truth of science is no static thing, for the scholar passes from truth to truth towards Eternal Truth in which he will find immortality. M. H. K.

* Summary of the Presidential Address delivered by Mr. Verrier Elwin, M.A (Oxon.), F.R.A.I., F.N.I., before the Anthropology Section of the Indian Science Congress held at Delhi last January.

SCIENCE NOTES AND NEWS

A central controlling authority to organise university education, in the interests of the country as a whole is suggested as a part of post-war educational reconstruction which has received the approval of the Central Advisory Board of Education. This authority is proposed to be constituted on lines analogous to the University Grants Committee in Great Britain. Its main function would be to settle the assessment and distribution of all grants from public funds and to enable universities to plan ahead. It will be empowered to encourage private benefactories, to co-ordinate university activities, to avoid overlapping and to adjusting the output of universities to the economic needs of the country, to examine and advise upon all schemes of major development, to prevent undesirable competition between universities and to remove all provincial barriers, to arrange for the periodic inspection of universities, to ensure the maintenance of standards, to establish cultural contacts and to arrange for the exchange of teachers and students with foreign universities.

A comprehensive plan of post-war educational development in India, based mainly on the Sargent Scheme, has been drawn up by the Central Board of Education and is being submitted to the Reconstruction Committee of the Viceroy's Executive Council. The Scheme is the result of the work of the various Committees set up by the Board, including the two Wardha Education Committees. The total annual cost of the National system of education as envisaged by the Board will amount to 277 crores of rupees.

To advise the Government of India on problems of dehydration of meat, fish, fruits and vegetables an Empire Mission on Dehydration, consisting of Dr. J. C. Fiddler of the Ministry of Food and Cambridge Low Temperature Research Station, and Mr. T. C. Crawhall, Deputy Director, Dehydration, Ministry of Food, are now touring India. They will visit important factories in India where dehydration of meat, fish, fruits and vegetables for the army is being carried on and also the centres of supply of these products. They will also visit research centres in India.

It is proposed to establish a Central Coconut Committee which will, in the first instance, as a war measure, be entrusted with the task of stepping up the production of the produce by improved methods of manuring and cultivation. The necessary funds for the purpose will be met by the levy of a cess at Rs. 3-2-0 per ton of copra consumed by the mills. The annual revenue from this source is expected to amount to three lakhs.

The half-yearly meetings of the Indian Central Cotton Committee began on the 24th January and concluded on the 29th January 1944, Sir Pheroze Kharegat, C.I.E., I.C.S., Vice-Chairman of the Imperial Council of Agricultural Research, presiding. His Excellency the Governor of Bombay, Sir John Colville, attended the meeting of the main Committee on the 28th January and paid tribute to the work done by the Committee for the improvement of Indian cotton and in the interests of the cotton industry as a whole.

Sir Chunilal B. Mehta was elected Vice-President for the year 1944-45, and the following were appointed to constitute the Standing Finance Sub-Committee for the same period: Sir Chunilal B. Mehta (Vice-President) (*Chairman*), Sir Pheroze Kharegat, C.I.E., I.C.S. (*ex-officio*), Sir Chunilal V. Mehta, K.C.S.I., Sir Purshotamdas Thakurdas, C.I.E., M.B.E., Sir Sorab Saklatvala, Mr. J. L. Hurschler, Rao Bahadur Sir Madhaorao Deshpande, K.B.E., Mr. W. J. Jenkins, C.I.E., Mr. R. G. Saraiya, O.B.E.

There were some seventy items on the agenda, most of which, however, had been previously reviewed by the appropriate Sub-Committees and the Committee considered them in the light of the recommendations made on them by the Sub-Committees. Considerable discussion centred round the question of the desirability of taking legislative or other measures to prevent mixing of cottons in India. The consensus of opinion was strongly in favour of immediate action in the matter but, in view of the complexity of the problem, it was finally decided to authorise the Local Sub-Committee to go into the matter fully and suggest measures for stopping the malpractice.

Among the new schemes sanctioned by the Indian Central Cotton Committee, are a scheme for cotton physiological research, a scheme for improvement of Hill cottons in Assam, a scheme for distribution and multiplication of "Vijaya" in Baroda District and a scheme for distribution and marketing of Jarila in the Central Provinces and Berar. The following schemes due to terminate in the course of the year have been recommended for extension for varying periods:—(1) Central Provinces and Berar Cotton Breeding Scheme, (2) Mysore Doddahatti Scheme, (3) Scheme for co-ordination of research on Black-headed Cricket in Sind and Baluchistan, (4) Scheme for distribution and marketing of V. 434 cotton in Central Provinces and Berar, and (5) Scheme for grading and marking of 1027 A.L.F. and "Suyog" cottons in Surat District.

About 15 million acres of waste land will be brought under land development and reclamation scheme by the Government of Bombay as

a major part of its post-war reconstruction plan. The total cost of the scheme is expected to be Rs. 15 crores and its working is expected to extend over a period of five years. An essential phase of the development is the large-scale contour-bunding to conserve the available water-supply and to enable the extension of scientific dry farming. Afforestation and terracing of hill sides will be undertaken to conserve water.

The Government of India have entrusted to the Drugs Technical Advisory Board, established under the Drugs Act, 1940, the task of preparing an Indian Pharmacopœial list.

The Indian Metallurgical Association has donated a sum of Rs. 10,000 to the Council of Scientific and Industrial Research to be utilised by the Council, at its discretion, for the purpose of "promoting, encouraging and benefiting the interests of metallurgical industry in India".

With a view to widen the scope of the activities in industrial research in relation to the development of industries in the State, and to secure a closer and more effective contact with the Board of Scientific and Industrial Research of the Government of India, the Government of Mysore have reconstituted the Board of Industrial Planning and Co-ordination in Mysore. The reconstituted Board has been named the Board of Scientific and Industrial Research, and consists of eight members including Sir C. V. Raman, Sir J. C. Ghosh and Sir M. O. Forster.

The Hon'ble Mr. M. S. A. Hydari, C.S.I., C.I.E., I.C.S., Secretary, Department of Industries and Civil Supplies, was elected Vice-President of the Council of Scientific and Industrial Research, for a term of two years, at the meeting of the Governing Body of the Council held at Bangalore on December 1, 1943.

Sir Shanti Swarup Bhatnagar, Kt., F.R.S., Director, Scientific and Industrial Research, Delhi, has been elected Vice-President of the Society of Chemical Industry in London.

Dr. B. Viswa Nath, who has just retired from the Directorship of the Imperial Agricultural Research Institute, has accepted the offer of the Government of Madras, to take charge of the Director of Agriculture from the 15th April 1944.

It is understood that Sir S. S. Bhatnagar, Kt., F.R.S., will fly to Chunking in response to an invitation which has been extended to him by the Chunking Government.

On the recommendation of the Vincent Massey Scholarship Selection Committee, H. E. the Viceroy has awarded the Vincent Massey Scholarship for 1943-44 to Mr. P. S. Anantha Narayan, Labour Officer, the Tata Oil Mills Company, Bombay.

Nature, December 1943, records the obituary of Dr. W. H. Hatfield, F.R.S., the famous metallurgist and Director of Brown Firth Research Laboratories, Sheffield. The success of the "18 : 8" nickel chromium steel to which Firths gave the name of "Staybrite" is largely due to his energetic efforts. He made a detailed study of the properties of austenitic stainless steels, especially of the intercrystalline corrosion to which they were liable under certain conditions, as when welded. He was elected a Fellow of the Royal Society in 1935.

Dr. A. S. Kalapesi's Presidential Address to the Geology and Geography Section deals with a brief review of the geographical and geological features of "The Bombay Island". Starting from the earliest reference to this part of the West Coast of India so far back as 150 A.D. by Ptolemy, Dr. Kalapesi proceeds to give a detailed historical account of the gradual evolution of the Bombay Island as a single unit from seven different islands. He next deals with the rocks of the Island and points out that while the main rock formation throughout the area is the Deccan Trap, there are evidences here of three or four 'local' and 'secondary' effusions of lava which seem to have taken place sometime after the main Deccan Trap eruptive activity came to an end, and are perhaps connected with the foundering of the land which extended towards the west of the present coastline of the Peninsula after the highest Deccan lava flows had consolidated. The Address concludes with a general account of the younger volcanic rocks due to these different 'effusions' and their distribution in different parts of the Island.

In his Presidential Address to the Mathematics and Statistics Section, Dr. B. M. Sen purports to give an account of quantum mechanics from the standpoint of a mathematician. A brief description of the Bohr Theory is followed by a mention of the matrix mechanics, and the Schrödinger Equation. Dirac's relativistic wave equation is then touched upon, and a reference is made to Eddington's theory. A brief mention is also made of the theory relating to particles of spin zero and one.

The Government of India have entrusted to the Drugs Technical Advisory Board established under the Drugs Act, 1940, the task of preparing an Indian Pharmacopœial List.

There are a number of drugs of Indian origin which are of sufficient medicinal value to be officially recognised and which are prescribed in India by practitioners of modern scientific medicine not included in the British Pharmacopœia. Pharmacopœial drugs are also produced in India from medicinal plants of a slightly different species from those described as standard in the British Pharmacopœia. It is necessary to prescribe official standards for such drugs in order to secure uniformity of strength, quality and purity.

The Indian Pharmacopœial List will be the official standard for drugs not included in the British Pharmacopœia and will serve as the official Supplement to the British Pharmacopœia. In preparing the List the Board will have the advantage of the considerable material collected as a result of the enquiry into

indigenous drugs conducted over a period of years under Lt.-Col. Sir R. N. Chopra.

At the annual general meeting of the Indian Botanical Society held at Delhi early last month, Prof. Yajnavalkya Bharadwaja, Head of the Department of Botany and Dean of the Faculty of Science, Benares Hindu University, was elected President of the Society. The following, among others, were elected members of its Executive Council:—Prof. Birbal Sahni, F.R.S. (Lucknow), Principal P. Parija, O.B.E., I.E.S. (Cuttack), Dr. T. S. Sabnis, I.A.S. (Cawnpore), Prof. S. P. Agharkar (Calcutta), Prof. T. S. Raghavan (Annamalainagar), and Prof. F. R. Bharucha (Bombay).

The Madras Engineers' Association has transferred Rs. 15,000 from its funds to the University of Madras for the institution of a research scholarship in Engineering.

SEISMOLOGICAL NOTES

Among the earthquake shocks recorded by the seismographs in the Colaba Observatory, Bombay, during the month of November 1943, there were two of great, two of moderate and five of slight intensities. The details for those shocks are given in the following table:—

Date	Intensity of shock	Time of origin I.S.T.		Epicentral distance from Bombay	Co-ordinates of epicentre (tentative)	Depth of focus	Remarks
		H.	M.	(Miles)		(Miles)	
2	Slight	10	09	1370	..	..	..
3	Moderate	00	38	7700	..	..	..
3	Moderate	21	02	6550	..	..	..
6	Great	15	02	4490	..	130	..
24	Slight	19	47	3160	..	..	..
27	Great	04	51	2890	..	..	Epicentral region in Turkey. Great loss of life and property reported in press.
27	Slight	15	15	910	..	..	..
28	Slight	12	50	3640	..	..	..
30	Slight	03	48	5070	..	..	..

Three crystal reliquaries have been discovered at a Buddhist site, known as Salihundam, near Chicacole in the extreme north of the Madras Presidency.

The attention of the Archæological Department was attracted to the site over twenty years ago. Last year a group of Buddhist religious buildings consisting of a chaitya and three stupas were discovered. One of them has now yielded three crystal reliquaries within three stone relic-boxes. The crystal caskets are hemispherical and are shaped like stupas and contain gold leaves embossed with lotus leaf decorations.

The remains at Salihundam indicate the flourishing state of Buddhism in the northern Andhra country under the Ikshvaku rulers.

Prof. Moses Ezekiel, Professor of Botany, Wilson College, Bombay, has observed that *Sopubia delphinifolia*, a well-known root-parasite on grasses, also parasitises the tomato plant. A distinct root connection between the host and the parasite has definitely been established.

The C. P. and Berar Provincial Board of the All-India Manufacturers' Organization has invited the All-India Manufacturers' Organization to hold its fourth Annual Session at Nagpur on 26th and 27th February 1944. Sir M. Visvesvaraya has kindly consented to preside.

Among the earthquake shocks recorded by the seismographs in the Colaba Observatory, Bombay, during the month of December 1943, there were one of moderate and five of slight intensities. The details for those shocks are given in the following table:—

Date	Intensity of shock	Time of origin (I.S.T.)		Epicentral distance from Bombay	Co-ordinates of epicentre (tentative)	Depth of focus
		H.	M.	(Miles)		(Miles)
3	Slight	11	08	4810	..	
5	Slight	09	46	1230	..	100
6	Slight	12	40	2520	..	70
12	Slight	22	24	1270	..	..
13	Slight	14	23	1350	..	..
24	Moderate	01	24	7610	..	..

MAGNETIC NOTES

Magnetic conditions during January 1944 were less disturbed than in the previous month. There were 14 *quiet* days and 17 days of *slight* disturbance as against 18 quiet days, 11 days of slight disturbance and 2 days of moderate disturbance during the same month last year.

The quietest day during the month was the 30th and the day of the largest disturbance the 1st.

The individual days during the month were classified as shown below:—

Quiet days	Disturbed days	
	Slight	Moderate
4, 5, 7–9, 19–24, 28–30.	1–3, 6, 10–18, 25–27, 31.	

No magnetic storm occurred during the month of January 1944, while two moderate disturbances were recorded in January 1943.

The mean character figure for the month of January 1944 was 0·55 as against 0·48 for January last year.

A. S. CHAUBAL.

University of Madras.—Applications are invited for the following appointments in the University of Madras:—

(1) Director (Professor) of the Research Laboratory in Zoology on a salary of Rs. 750-50-1,000.

(2) Director (Professor) of the Research Laboratory in Botany on a salary of Rs. 750-50-1,000.

Applicants should be graduates of Indian or British Universities with high academic qualification and should have sufficient experience of research work. For appointment to the post of Director (Professor) of the Zoological Laboratory, a knowledge of Marine Zoology will be an additional qualification.

Applications (eight copies) containing full particulars regarding (i) age, (ii) religion and caste or community, (iii) academic and other qualifications, (iv) original research and publications, if any (copies to be submitted), (v) present position and salary, together with copies of recent testimonials and names of two persons to whom a reference can be made, should be sent so as to reach the Registrar, University of Madras, Chepauk, Triplicane, Madras, on or before the 15th March 1944, with the envelope superscribed as "Director, Zoology/Botany Laboratory".

(3) Professor in the Department of Chemical Technology on a salary of Rs. 750-50-1,000.

Applicants should (i) possess high academic qualification, (ii) have wide experience in Chemical Technology or Chemical Engineering, (iii) possess a degree of a recognised university and (iv) be able to produce a record of research in one of these subjects. The person selected for the appointment will be required to organise the Department of Chemical Technology, direct research in Chemical Technology, or Chemical Engineering, and generally to do such work as may be necessary for the starting and working of the Department.

Applications (eight copies) containing full particulars regarding (i) age, (ii) religion and caste or community, (iii) academic and other qualifications, (iv) previous teaching and technical experience, (v) original research and publications, if any (copies to be submitted), (vi) patents, if any, and (vii) present position and salary, together with copies of recent testimonials and names of two persons to whom a reference can be made should be sent so as to reach the Registrar, University of Madras, Chepauk, Triplicane, Madras, on or before the 15th March 1944, with the envelope superscribed as "Professor in the Department of Chemical Technology".

The appointments will be, in the first instance, for a period of three years and will be subject to confirmation at the end of that period.

It will be open for the appointing authority to select a candidate for appointment either in the grade of Professor or in the grade of Reader (Rs. 400-25-600), taking his qualifications and experience into consideration. It will also be open for the appointing authority, in exceptional circumstances, to make short-term contract appointments on special terms.

Further particulars relating to the above appointments can be had from The Registrar, University Buildings, Chepauk, Madras.

The 1944 Easter Session of the Indian Academy of Sciences will be held at Madras from 7th April 1944 to 9th April 1944 in the University Buildings. Apart from the reading of papers, there will be special discussions on "Luminescence" and "Hydrogen Bonds".

We acknowledge with thanks the receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 92, Nos. 4653-4654.

"Journal of Agricultural Research," Vol. 67, Nos. 3, 5 and 6.

"Agricultural Gazette of New South Wales," Vol. 54, Pts. 11-12.

"Allahabad Farmer," Vol. 17, No. 6.

"Biological Reviews," Vol. 18, Nos. 3-4.

"Journal of the Indian Botanical Society," Vol. 22, Nos. 5-6.

"Biochemical Journal," Vol. 37, No. 4.

"Journal of Chemical Physics," Vol. 11, No. 10.

"Journal of the Indian Chemical Society," Vol. 20, No. 11.

"Chemical Products and Chemical News," Vol. 7, Nos. 1-2.

Industrial and News Edition of the "Journal of the Indian Chemical Society," Vol. 20, Nos. 3-4.

"Endeavour," Vol. 1, Nos. 1 to 4; and Vol. 2, Nos. 5 to 8.

"Experiment Station Record," Vol. 89, No. 4.

"Indian Farming," Vol. 4, No. 8.

"Indian Forester," Vol. 70, No. 1.

"Indian Forest Records," Vol. 3, No. 4.

"Indian Forest Leaflet," No. 57—1943, and 61.

"The Quarterly Journal of the Geological, Mining and Metallurgical Society of India," Vol. 15, No. 3.

"Chronicle of the Health Organisation," Special Number, October 1943.

"Bulletin of the Indian Central Jute Committee, Vol. 6, Nos. 9-10.

"Journal of the Indian Mathematical Society," Vol. VII, Nos. 1-2.

"Mathematics Student," Vol. 10, No. 4.

"Indian Medical Gazette," Vol. 78, No. 12; Vol. 79, No. 1.

"The Review of Applied Mycology," Vol. 22, Pts. 10-11.

"American Meteorological Society Bulletin," Vol. 24, No. 56.

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